BUSINESS ARITHMETIC

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BUSINESS ARITHMETIC

By

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FOR USE IN ALL SCHOOLS OFFERING THE SUBJECT OF BUSINESS ARITHMETIC

SECOND EDITION

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PREFACE

The purpose of this text is to serve as a basis for a course in the arithmetic needed by the individual and the business man in the solution of problems arising from the completion of business transactions. The fundamental principles of arithmetic are applied in the same manner as in all arithmetics. Special emphasis is given to accuracy and speed in the application of these principles.

The authors have undertaken to make the text interesting and instructive by:

(1) The selection and arrangement of practical and interesting material.
(2) The use of practical problems for illustrating the application of the principles.
(3) A change in the approach to the various subjects.
(4) A discussion of the business questions covering the problems of business transactions.

Problems have been selected that correlate with the everyday activities of school, home, society, and business. These problems are presented in exercises, each of which relates to a specific phase of arithmetic. A model solution is provided in connection with each group with a view of emphasizing the systematic solution of the problems and the use of efficient methods in the solution. Sufficient problems are provided to insure accuracy and speed, the two important elements in the solution of business problems.

The discussion in the text is arranged in four principal groups. The first group relates to the fundamental principles, the second to fractions, the third to percentage, and the fourth to interest. Each group contains two or more chapters, one or more of which consists of problems requiring the application of the principles discussed.

The necessity for proof of mathematical calculations and the means of effecting this proof is developed early in the course.

Accuracy in the solution of mathematical problems applicable to industry is essential to successful business operation. The business man must know the facts regarding the operations of his business and he can know that the facts submitted to him are correct only when their correctness has been proved by a reasonable test. Speed in the solution of mathematical problems can be obtained only through continued practice and quick thinking, hence the necessity for numerous oral drills in an arithmetic which emphasizes accuracy and speed.

Fractions are necessary in business calculations. Special emphasis is given to this phase of arithmetic. Seven chapters are devoted to common and decimal fractions, with two chapters of problems requiring their application to business transactions.

Percentage and interest, which are applications of decimal fractions, are thoroughly developed in five chapters, two of which are practical problems. The problems of the business man are discussed in nine chapters. These relate to the banker, the merchant, and the manufacturer. Six chapters are devoted to the problems of the individual. These include stocks and bonds, insurance, taxation, and the means and methods of measurements.

The purpose of the revision was to group the problems in exercises, each exercise relating to a specific phase of arithmetic. All of the problems have been brought up to date, and many new problems added. The interest manifested by our friends through helpful suggestions and problems is very much appreciated. Their cooperation has helped to make the text more teachable and more interesting.

THE AUTHORS

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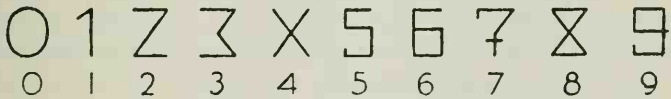
CHAPTER I

INTRODUCTION

As soon as primitive man began to compare one group of objects with another group he began to observe and think in numbers. Very soon, then, he sought to express his number-thoughts, and having neither words nor figures for the purpose he very naturally used his fingers and toes, or made *marks*, *scores*, just as the baseball umpire of today uses his fingers to indicate *strikes* and *balls* and keeps the *score* by *tallies*; thus, 𝍸 111 (=8).

The naming of each unit in a succession probably came next. Counting naturally developed along the *ten* or *decimal* scale. If man had had twelve fingers instead of ten it is quite likely that all counting would go in twelves instead of tens.

The greatest advance step in Arithmetic came with the selection of signs for the different groups, and the perfection of our present system of writing and reading numbers. Many explanations have been offered concerning the origin of the ten digits,* figures. The following appears to be the most probable, and is quite acceptable. Certain arbitrary forms were selected, and their values known by the number of angles.



It is easy to understand how these awkward angular forms came to be written as they are today. Some of the old earmarks remain, however, for we often see the figure *one* with its flag at the top, and many of the latin peoples still flag the staff of the *seven*.

The idea of *place values* was a very remarkable discovery and has meant much for civilization. That a 2 in the first position should mean two; in the second position twenty, etc., seems

*Digits originally meant fingers.

simple to us today, but think how long it would take you to develop the plan for yourself.

Having so far mastered the problem of counting and numbering, man turned to the comparison of distance. He found it necessary to have a unit of measure as a basis, and having nothing so unvarying or so handy as his own body, he used *it*. Distance, he measured in foot-lengths, *feet;* or in step-lengths, *paces;* in hand-breadths, *hands;* or hand-reaches, *spans;* in elbow-to-finger-tips, *cubits;* or finger-tip-to-finger-tips, *fathoms.*

From time to time, standards of measurement have been set up as the progress of civilization required. *Area* began to be measured when land became scarce; *capacity,* when drink other than water came into use, and *weight* when precious metals and other commodities were exchanged in trade. The last came slowly, however; only in very recent years have fruits been sold by the pound.

It is interesting to notice the development of measurements. Today we measure the *air* pressure and determine altitudes, measure its density and predict the weather; we measure the temperature, and the speed of the wind—in fact the speed of everything that moves. *Power,* too, is measured; the word *horse-power* stands as a monument to the passing horse; steam has its *pounds-pressure* and electricity, its *volts, amperes, ohms* and *watts.*

Measuring has become so nearly a fine art that variations of more than a thousandth part of an inch in machine and tool manufacturing are practically out of the question. Mechanical devices for making these measurements have been invented, also numerous machines for the common computations of business. The automatic reel has replaced the old yardstick at the dry goods counter; the automatic measuring pump fills the gasoline tank, and the adding-calculating machine does all the detail figuring of the office.

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Fundamentally, arithmetic consists of but three general processes: the *increasing, diminishing,* and *comparison* of numbers. These are included in the four fundamental operations: addition, subtraction, multiplication, and division. Through the process of addition, numbers are increased; through the process of subtraction, numbers are decreased; through the processes of multiplication and division, numbers are compared.

Business Arithmetic does not involve any new mathematical principles; it refers to the application of the four fundamental operations to the solution of business problems. These problems arise from the completion of business transactions which occur in the operation of a business. The results affect the individual as well as the business. You need a knowledge of the arithmetic of business, because of the business transactions which you will perform while attending school, and after you have finished school and entered the business world.

The first essential in business arithmetic is accuracy, and the second is speed. The application of the principles is not sufficient for you or for the business man, unless the results are correct. The value of your services to the business world will depend, to a great extent, upon your ability to apply accurately and quickly the fundamental operations of arithmetic to the solution of business problems.

Mention is made in this text of the procedure used by bookkeepers for recording transactions so that the results may be proved, because practically all transactions you perform now, or will perform when you enter the business world, will be affected by the application of this procedure. The correlation of business arithmetic with the problems of bookkeeping will help you to better understand arithmetic, and to appreciate the necessity for accuracy in all mathematical calculations. A knowledge of the fundamental principles of bookkeeping is not necessary in order to understand business arithmetic, but a knowledge of business arithmetic, and accuracy in its application, is essential to the successful completion of a course in bookkeeping.

The ability to reason is necessary in the solution of all business problems. A knowledge of the principles involved, the four fundamental operations of arithmetic, and even the ability to apply these quickly and accurately, does not always indicate the ability to apply them to the solution of business problems. You may know how to add, subtract, multiply, and divide, and be able to perform each process with accuracy and speed, but this ability might not enable you to apply these principles to the statements of a real estate agent regarding the purchase of a home, and the saving that might be effected thereby. As a merchant you might apply these fundamental operations to each sale of merchandise with the assurance that the results will be correct,

but it will require reason to apply the results of these sales to the purchasing of merchandise with which to supply future customers.

Memory should be developed only in connection with the meaning of arithmetical signs and terms, and such tables as may be necessary in order to make an application of your problems to denominate numbers, interest, and the fixed ratio existing between diameter, circumference, etc. The application of the information given in these tables will require a knowledge of the principles. If you undertake to memorize the application of these principles to all the fundamental operations, your knowledge of arithmetic will be limited to the length of your memory. It may be possible to have access to the tables which contain the information to be memorized, but it is not always possible to have access to information regarding the principles. The one who is thoroughly familiar with the fundamental principles of arithmetic and understands the reason for short-cuts can always apply them, but the one who memorizes them from the statements given in the text without knowing the reason will find them difficult to remember.

Machines are available for the solution of practically all mathematical problems resulting from business operations but no machine has brains, hence the brains of the operator alone can make its operation successful. A knowledge of business arithmetic is necessary in order to successfully operate any machine provided for mathematical calculations. The phonograph, player piano, and radio have not eliminated the trained musician; the calculating machine has not eliminated the trained mathematical mind.

With the exception of a few problems necessary to emphasize the principles, all the exercises in this text relate to mathematical problems which have arisen through the completion of business transactions. If you will visualize these problems and place yourself in the position of those connected with the transactions from which the problems arose, you will find arithmetic more interesting and instructive. Even now you are performing transactions which require the application of business arithmetic for their solution. When you enter the business world to earn your own living, you will be continually performing transactions which require a knowledge of business arithmetic, no matter whether you choose your occupation from the professions or business.

CHAPTER II

ADDITION

The purpose of this chapter is to provide practice in addition through the application of some of the more popular short-cut methods, also to provide information regarding proof of the sum, or total. All the information given is based on the assumption that you understand the mathematical principles involved in connection with addition.

Addition is the process of finding the sum of two or more numbers, and expressing this sum in one number. The *sum*, or as it is often referred to in business, the *total*, is the number which expresses the value of the two or more numbers.

The amounts added, and the sum should refer to the same thing. If it is desired to ascertain the weight of three barrels of sugar, and the weight of each barrel is given, the sum of these three amounts would be the total quantity of sugar.

Combination. The process of addition is greatly facilitated by combining figures. Accuracy is essential to addition, but speed is necessary to secure accuracy and efficiency. Combinations will effect both accuracy and speed in addition.

At the top of the next page is given a list of the forty-five two-figure combinations that may be used in addition. There are nine hundred possible combinations in adding any one of the numbers, 1, 2, 3, 4, 5, 6, 7, 8, and 9 to numbers from one to one hundred. These nine hundred combinations include the forty-five two-digit combinations given in the table. If practiced diligently, they will be of great aid in rapid, accurate addition. You are not expected to memorize any of the combinations, but to practice combining figures until they can be read as readily as words.

With practice, you can learn to read the sum of four or five digits without mentally repeating the sum of each two digits. To acquire efficiency in combining more than two digits, it is necessary to begin with two digits and add additional digits as you become proficient.

EXERCISE No. 1, COMBINATIONS

The following problems provide oral practice in ascertaining the sum of two digits. Problem 1 shows the forty-five two digit combinations arranged in regular order; in problems 2–7, the combinations are arranged in a different order. Practice adding these until you can read the sum of any two digits.

1. Two-figure combinations:

1	2	3	4	5	6	7	8	9
1	1	1	1	1	1	1	1	1
2	3	4	5	6	7	8	9	
2	2	2	2	2	2	2	2	
3	4	5	6	7	8	9		
3	3	3	3	3	3	3		
4	5	6	7	8	9			
4	4	4	4	4	4			
5	6	7	8	9				
5	5	5	5	5				
6	7	8	9					
6	6	6	6					
7	8	9						
7	7	7						
8	9							
8	8							
9								
9								

When we first began to read we said b-o-y-s, *boys*, r-u-n, *run*. Now we read much faster for we have stopped spelling the words.

Why say "2 and 3 are 5 and 4 are 9," when it is just as easy to see that 2, 3, 4 are 9 as it is to see that r-u-n is *run*. *Read your results.*

2.

2	5	3	4	1	3	2	4	1	3			
2	4	1	1	3	2	3	1	4	3			

3.

1	5	4	3	5	6	1	4	5	7			
5	1	3	4	2	1	6	4	3	1			

4.

4	5	6	7	8	4	2	8	3	5			
5	4	3	2	1	5	7	1	6	4			

5.

7	8	9	6	7	8	4	9	6	5	5	6	
4	3	2	6	5	4	8	4	7	4	6	5	

6.

7	8	8	8	9	7	9	8	5	6	7	8	
7	7	8	9	8	6	4	9	9	7	9	7	

7.

2	3	4	3	8	7	6	5	9	3	3	4	
9	7	5	6	1	8	6	5	9	9	8	7	

EXERCISE No. 2, COMBINATIONS

The following problems provide oral practice in combining two figures the sum of which is ten. These combinations occur quite frequently, hence their use will mean speed and accuracy in addition.

1.	7	6	5	3	8	4	9	6	2	1	7	5
	3	4	5	7	2	6	1	4	8	9	3	5
2.	1	8	6	9	4	8	3	5	6	7	6	2
	9	2	4	1	6	2	7	5	4	3	4	8
3.	6	7	5	3	8	4	9	6	8	1	3	5
	4	3	5	7	2	6	1	4	2	9	7	5
4.	5	8	7	6	3	2	7	9	8	4	5	6
	5	2	3	4	7	8	3	1	2	6	5	4

EXERCISE No. 3, COMBINATIONS

The following problems provide oral practice in combining three or more figures, the sum of which is ten. With practice, the eye can grasp three figures, or even four, as well as two. The ability to see three or four figures which equal ten will enable you to attain greater speed when adding a column of figures.

1.	4	2	5	1	3	6	3	4	3	1	7	1
	5	3	1	6	4	3	2	1	6	8	2	5
	1	5	4	3	3	1	5	5	1	1	1	4
2.	7	1	3	4	3	2	5	6	7	3	5	1
	2	8	6	1	2	3	4	1	1	6	2	1
	1	1	1	5	5	5	1	3	2	1	3	8
3.	8	5	7	1	2	6	5	7	4	3	1	6
	1	2	2	8	3	1	3	1	3	1	8	3
	1	3	1	1	5	3	2	2	3	6	1	1
4.	1	2	1	4	3	5	2	1	3	2	1	2
	2	1	3	1	2	1	3	5	4	1	3	1
	2	4	2	3	2	2	3	2	2	4	1	2
	5	3	4	2	3	2	2	2	1	3	5	5

NOTE: It is customary to add from the bottom to the top and when re-adding for proof, to add from the top to the bottom. You are to follow this method unless otherwise instructed.

EXERCISE No. 4, COMBINATIONS

The following problems provide oral practice in combinations of ten. In each case you are to substitute a figure which will make the sum equal ten.

1.	?	6	8	?	6	?	?	2	7	9	?	2
	5	?	?	9	?	5	4	?	?	?	3	?
2.	6	?	?	9	8	5	?	?	?	3	?	4
	?	4	8	?	?	?	2	3	6	?	9	?
3.	4	7	?	2	4	?	?	5	6	?	8	?
	?	?	8	?	?	1	3	?	?	9	?	7
4.	?	?	8	?	5	6	?	4	?	8	?	7
	2	4	?	5	?	?	3	?	9	?	7	?
5.	1	?	5	?	1	4	?	?	3	8	?	5
	?	2	2	6	?	?	6	7	?	1	6	3
	7	2	?	2	4	5	1	2	4	?	3	?
6.	?	3	4	?	1	4	?	2	7	?	6	5
	2	4	2	6	?	?	4	4	?	8	2	?
	5	?	?	3	7	2	1	?	2	1	?	3
7.	6	4	?	3	5	8	2	7	6	?	3	3
	3	?	3	5	?	1	6	?	3	5	4	?
	?	5	3	?	2	?	?	2	?	2	?	5
8.	?	2	?	4	3	?	1	5	?	?	6	5
	2	?	5	2	4	6	?	2	3	8	2	?
	7	3	2	?	?	2	6	?	5	1	?	4
9.	1	3	?	2	?	5	?	3	6	4	2	?
	2	?	4	?	4	4	3	?	2	2	?	1
	?	6	2	3	1	?	5	4	?	?	7	5
10.	?	4	8	?	6	?	1	3	?	2	7	5
	3	2	?	7	?	5	6	4	8	?	2	?
	6	?	1	2	3	2	?	?	1	2	?	3
11.	?	6	3	1	3	2	3	7	?	?	4	2
	2	1	?	?	?	1	4	?	4	5	?	7
	3	?	3	8	6	?	?	1	1	1	4	?

EXERCISE No. 5, COMBINATIONS

The following problems provide oral drill in combining three or more figures, the sum of which does not equal ten.

1.	3	7	3	8	4	6	9	3	7	4	5	7
	5	4	7	2	9	4	8	3	6	2	7	9
	5	3	7	8	7	3	2	8	3	8	9	4
2.	4	5	8	7	9	6	4	7	5	3	2	5
	1	3	1	2	2	5	4	4	1	7	7	2
	6	4	2	2	1	1	4	1	6	2	3	5
3.	8	9	7	9	8	7	8	7	9	6	7	9
	7	5	6	9	4	5	3	6	8	3	4	6
	8	3	8	2	9	6	9	5	7	8	2	5
4.	1	0	3	4	1	9	1	2	7	3	2	4
	5	3	1	6	3	2	4	3	6	2	1	6
	3	2	7	8	7	1	8	8	7	4	5	5
	2	9	6	2	9	8	5	7	2	2	7	5
5.	2	5	6	8	2	4	8	9	7	3	1	4
	4	6	2	8	9	4	6	2	8	3	5	6
	4	6	8	3	9	8	4	8	5	3	2	5
	5	4	9	7	7	4	7	2	8	5	8	8

EXERCISE No. 6, COMBINATIONS

The following problems provide oral drill in seeing the tens in a column of figures, and combining them with other figures. Thus, if the first and second, or the first and third figures to be added equal ten, and the third figure is eight, it is necessary to see these figures as eighteen.

1.	8	6	3	2	5	4	7	1	5	8	9	3
	4	4	7	8	7	6	3	9	5	8	1	3
	6	5	6	3	3	7	9	6	8	2	4	7
2.	7	3	2	5	4	1	7	1	5	8	9	3
	3	6	8	5	6	9	5	6	8	2	4	3
	7	4	7	4	8	6	5	4	2	9	6	7
3.	3	9	8	5	1	7	4	5	2	3	6	8
	7	1	7	5	9	3	8	6	8	4	6	8
	7	1	7	5	9	3	8	6	8	4	6	8
	5	6	3	8	8	2	2	4	8	6	4	2

EXERCISE No. 7, COMBINATIONS

The following problems provide oral drill in combining two figures the sum of which equal ten with two figures the sum of which may or may not equal ten.

1.	6	3	4	5	6	2	1	3	5	8	7	2
	4	7	3	8	3	8	9	4	5	2	5	8
	5	8	5	3	4	8	3	6	6	5	5	4
	8	2	5	7	6	3	7	4	8	7	5	3
2.	4	5	5	6	6	3	8	4	3	5	8	5
	3	5	7	8	4	7	3	6	7	5	2	8
	8	5	2	5	4	9	8	3	8	3	7	4
	2	7	8	5	5	3	2	4	2	8	6	6
3.	5	7	8	4	7	3	6	7	5	2	8	3
	5	5	6	6	3	8	4	3	5	8	5	4
	8	3	6	8	3	9	2	4	8	4	7	3
	2	7	4	1	8	1	8	5	2	7	3	7
4.	3	9	4	3	7	8	7	3	1	7	6	7
	2	1	6	8	3	9	3	9	9	3	7	9
	8	1	4	6	9	4	8	9	7	3	5	5
	7	6	9	4	1	6	8	1	8	9	5	5

EXERCISE No. 8, COMBINATIONS

The following problems provide oral or written practice in combining two figures when adding a column of figures.

The brackets in the column of figures at the left indicate the combinations and the numbers to be read mentally as the column is added. Thus, the addition in this column would be expressed mentally as 10, 20, 27, 38.

Place a sheet of tablet paper just below the ruled line, and write your total on this sheet. Do not write in the text.

1.

	a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*
7 } 11	5	4	2	5	8	4	3	9	6	8
4 }	4	9	9	7	4	3	9	1	4	2
2 } 7	5	6	4	8	4	9	3	9	9	5
5 }	4	4	6	5	6	1	7	3	8	6
9 } 10	4	6	2	9	5	8	5	4	7	7
1 }	6	4	8	1	3	2	4	7	3	3
7 } 10	7	5	1	6	7	7	3	6	7	8
3 }	3	5	4	4	8	5	6	4	6	1
38										

(*Exercise No. 8—Continued from page 16*)

2.

a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*
8	8	6	3	5	9	8	7	6	4	8	5
2	7	8	4	5	1	1	3	3	9	7	5
6	2	8	8	8	8	6	3	7	5	6	8
8	8	2	2	9	7	4	6	3	5	4	7
4	9	7	7	6	3	4	8	9	6	5	9
3	3	6	7	5	5	5	2	1	7	9	3
7	5	4	8	8	6	8	7	5	3	5	4
9	5	6	9	2	4	5	5	5	8	5	6
4	7	5	4	9	4	3	4	4	6	7	7
7	4	5	6	1	8	7	6	8	4	5	3
–	–	–	–	–	–	–	–	–	–	–	–

3.

a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*
7	8	7	8	7	9	6	5	9	7	3	5
3	8	3	2	7	1	4	5	1	3	7	7
2	6	5	7	8	7	8	4	7	7	9	2
3	4	5	3	5	8	4	9	5	5	4	8
5	5	2	4	2	5	5	8	3	9	6	7
8	5	3	6	8	5	5	2	7	1	5	5
2	3	5	5	6	8	9	3	8	2	5	6
7	7	6	8	4	6	4	7	2	8	8	4
3	8	4	9	9	2	3	4	8	4	2	9
–	–	–	–	–	–	–	–	–	–	–	–

4.

a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*
7	2	9	1	5	8	4	3	9	5	6	7
3	5	1	4	7	9	2	8	6	4	3	1
5	8	4	5	1	2	7	5	3	8	9	4
6	4	7	8	9	3	6	2	1	6	3	2
4	1	2	6	4	1	9	4	5	3	2	5
8	6	3	3	2	4	1	6	7	2	8	6
9	3	5	2	3	6	5	1	2	7	1	3
1	7	6	7	8	7	8	9	4	1	4	8
2	9	8	9	6	5	3	7	8	9	5	9
–	–	–	–	–	–	–	–	–	–	–	–

EXERCISE No. 9, COMBINATIONS

The following problems provide oral or written practice in combining three figures when adding a column of many figures. The method of grouping is illustrated in the first column at the left. Write the results on a sheet of paper as instructed in Exercise No. 8. Do not write in the text.

1.

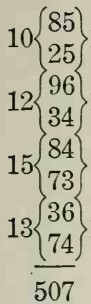
		a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*
1		2	7	3	2	3	4	5	1	6	8
3	6	1	4	2	3	2	2	1	7	3	1
2		7	1	3	6	6	4	4	2	2	1
4		3	5	5	6	2	5	4	6	3	7
5	10	4	6	3	5	4	2	2	5	2	5
1		2	1	2	1	4	3	3	1	5	1
2		1	1	2	7	5	1	6	3	4	2
3	9	6	2	4	3	2	3	3	3	2	3
4		3	5	2	2	4	6	1	3	5	7
3		6	3	3	4	2	6	5	8	7	1
6	10	2	6	3	5	2	4	1	2	4	5
1		2	1	2	1	6	4	1	2	4	5
4		5	2	1	7	5	4	2	4	5	2
2	8	3	1	7	3	5	3	4	3	3	6
2		1	7	2	6	1	2	7	3	2	2
		—	—	—	—	—	—	—	—	—	—
	43										

2.

a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*
3	7	4	6	2	5	6	1	8	9	7	4
2	3	5	2	3	3	5	7	1	1	5	3
2	2	1	2	5	2	5	2	1	2	3	3
5	4	2	2	7	6	5	3	3	2	4	1
2	2	3	1	1	2	1	4	5	6	1	7
3	4	3	3	3	2	4	6	2	2	5	2
1	5	6	5	4	7	3	2	3	1	2	3
7	3	3	2	3	3	6	1	6	7	5	1
5	3	1	3	2	2	1	7	1	2	3	6
4	6	7	8	3	6	2	3	5	4	1	3
5	1	1	2	4	3	4	3	2	5	6	1
1	3	2	4	1	4	5	4	3	5	3	4
2	5	4	3	3	5	6	2	6	3	6	5
3	4	1	3	2	3	3	5	6	2	4	1
4	5	3	3	5	4	4	3	4	5	3	2
—	—	—	—	—	—	—	—	—	—	—	—

EXERCISE No. 10, COMBINATIONS

When adding a column consisting of two or more figures, the figures in each column should be combined. When the sum of the figures in the units column is more than ten, the excess tens are carried to the tens column, and included in the first combination of that column.



The method of combining in each column is shown in the illustration at the left. The two figures which are combined are indicated by brackets, and the sum at the right or left of the brackets. The mental process when adding the first column should be "10, 17, 27, 37". Write the 7 and carry the 3. The process in the second column is "13, 28, 40, 50".

The following problems provide written practice in adding two-figure numbers. Write only the sum. Do not write in the text.

1.

a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*
17	29	22	86	36	24	74	63	14	55	33	47
28	81	88	25	74	56	56	47	26	75	72	23
36	46	36	47	75	38	38	57	78	23	28	68
16	83	14	23	67	72	72	68	39	87	16	29
92	37	93	65	98	81	21	22	23	68	46	37
85	83	17	54	16	24	84	86	45	97	34	51
63	14	35	72	22	75	75	43	78	36	48	42
48	35	26	38	36	35	35	77	46	74	92	14
23	89	85	36	41	98	41	96	94	26	73	33
87	21	65	74	69	89	69	48	82	34	39	23

2.

a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*
12	56	98	28	36	88	96	47	78	28	52	81
98	58	89	49	74	92	14	63	32	82	58	29
53	26	53	46	57	14	36	38	48	43	99	34
41	35	75	78	68	36	22	72	63	67	14	76
38	72	26	54	22	68	61	54	58	74	47	69
72	79	84	32	88	45	89	76	92	36	35	41
82	14	21	68	63	25	67	32	14	79	82	85
46	13	72	55	47	63	75	47	34	31	28	25
81	87	45	66	37	47	15	57	93	33	45	82
29	78	65	44	73	18	95	53	83	77	66	18

EXERCISE No. 11, COMBINATIONS

The following problems provide written practice in combining three figures in a group.

1.

		a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*
	27	72	32	83	91	56	26	42	56	67	82
10	32 10	43	56	75	36	13	65	33	24	22	34
	51	15	42	12	24	44	89	95	31	31	69
		63	12	34	82	97	31	24	82	45	13
	21	14	32	33	16	41	25	12	34	29	75
10	24 12	33	68	48	12	32	54	74	44	44	22
	67	21	73	66	74	45	32	21	67	89	96
		66	15	32	12	52	47	61	12	38	23
	96	23	22	12	24	13	85	28	31	42	41
17	23 10	82	86	48	59	98	55	23	96	25	75
	31	74	14	65	33	56	21	39	43	51	63
	372	54	19	23	24	62	34	95	28	34	52

2.

a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*
67	82	59	26	91	18	24	43	76	54	67	19
22	34	93	65	41	31	33	15	13	35	32	83
31	69	32	89	68	61	96	52	21	21	45	14
45	31	82	13	22	98	24	42	79	87	55	82
29	75	16	52	15	43	12	38	14	63	23	67
44	22	13	45	73	62	74	89	32	42	32	41
89	96	74	32	86	21	21	42	13	25	86	25
38	23	12	41	23	57	61	29	52	64	45	87
42	41	24	97	21	32	28	45	45	91	23	23
25	75	59	44	24	78	32	22	67	31	59	21
51	63	33	31	56	86	93	67	22	12	94	77
34	52	42	56	32	57	55	31	31	88	38	12

3.

a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*
64	78	78	56	32	47	56	98	45	85	25	83
46	14	56	34	78	73	82	12	82	13	58	14
91	72	45	32	13	83	78	47	37	78	52	82
78	37	65	78	85	92	56	47	73	16	97	74
32	57	29	15	67	18	74	35	14	89	75	14
14	83	81	95	34	41	36	92	83	92	35	22
96	27	64	34	76	73	14	89	98	67	48	36
76	16	37	76	39	85	82	36	89	43	72	82
54	94	85	13	61	25	67	74	37	93	57	18

EXERCISE No. 12, WRITING THE SUM

When adding a column containing many numbers with two or more figures in each number, it is advisable to indicate the sum of the figures in each column as it is added. This plan avoids the necessity of re-adding columns in case the one who is adding is disturbed during the process of addition.

4827		2038	
9638		5839	
4924		6382	
3725		1487	
5125		3154	
6849		5537	
7524		3944	
3579		1458	
2845		4157	
2454		3648	
60		3148	59
33		4958	68
61		6178	82
45		7893	91
51490		59821	

In the illustration at the left the sum of each column is written at the bottom, and arranged so that they may be added, thus avoiding carrying the excess.

In the illustration at the right the excess units are carried when adding the tens column, and the excess tens carried when adding the hundreds column. The total of each column is written at the right, units first, tens second, etc. The sum is the top number, and the right-hand figures in the numbers below it. In either method, the one adding knows the total of the last column added if he is disturbed before he has finished.

The following problems provide written practice in addition. Write on tablet paper the totals in problem 1 as in the illustration at the left, and in problem 2 as in the illustration at the right.

1.	*a*	*b*	*c*	*d*	*e*	*f*
	28,427	18,572	38,725	37,928	27,846	49,385
	78,492	61,424	49,281	41,672	52,317	42,345
	27,463	37,296	30,427	37,097	74,283	97,485
	95,927	75,735	35,729	25,562	37,208	38,475
	42,379	82,046	86,428	37,981	52,172	94,857
	28,446	27,593	72,823	27,439	78,539	38,476
	48,937	41,275	67,129	41,924	37,296	98,723
	29,452	39,256	43,552	27,096	73,814	78,454
	38,247	52,938	27,949	35,243	28,359	59,287
	40,542	43,725	37,472	17,241	46,294	51,823

2.

a	*b*	*c*	*d*	*e*	*f*
34,857	78,394	56,783	79,385	69,456	43,756
78,923	23,785	54,238	78,365	31,584	41,385
34,867	87,325	48,375	67,745	74,837	81,385
92,867	89,486	98,736	32,286	82,937	29,487
47,385	47,832	23,474	11,374	14,658	45,179
65,784	63,258	87,264	18,476	24,158	28,576
98,375	89,375	23,645	47,647	14,785	14,783
63,847	78,263	89,465	63,463	53,856	37,859
34,576	45,732	45,784	42,374	56,793	72,364
74,573	65,325	74,327	74,583	54,387	37,462
46,681	45,723	81,375	84,632	73,487	38,344
23,437	38,473	47,435	26,431	38,983	89,483

EXERCISE No. 13, PROGRESSIVE ADDITION

Progressive addition gives excellent practice in combining numbers. The following drills provide oral practice in progressive addition. You are to add in each case to approximately 100.

1. Begin with 3 and count by 2's; 4's; 6's; 8's
2. Begin with 2 and count by 3's; 5's; 7's; 9's
3. Begin with 9 and count by 5's; 7's; 9's; 3's
4. Begin with 11 and count by 4's; 6's; 8's; 2's
5. Begin with 14 and count by 6's; 2's; 4's; 8's
6. Begin with 19 and count by 7's; 3's; 5's; 9's
7. Begin with 16 and count by 9's; 7's; 5's; 2's
8. Begin with 11 and count by 8's; 2's; 4's; 6's
9. Begin with 13 and count by 3's; 5's; 7's; 9's
10. Begin with 14 and count by 7's; 3's; 5's; 9's
11. Begin with 8 and count by 9's; 5's; 7's; 3's
12. Begin with 5 and count by 7's; 3's; 5's; 9's
13. Begin with 6 and count by 2's; 4's; 6's; 8's
14. Begin with 4 and count by 5's; 3's; 7's; 9's
15. Begin with 9 and count by 8's; 2's; 4's; 6's
16. Begin with 7 and count by 6's; 4's; 6's; 8's
17. Begin with 6 and count by 4's; 6's; 2's; 8's
18. Begin with 8 and count by 7's; 3's; 5's; 7's
19. Begin with 7 and count by 3's; 5's; 3's; 7's
20. Begin with 5 and count by 8's; 4's; 2's; 6's

EXERCISE No. 14, COMBINATIONS

The following columns are to be added and the total written on a sheet of paper. Use either of the methods illustrated in Exercise No. 12.

1.

a	*b*	*c*	*d*	*e*	*f*	*g*	*h*
3,156	7,894	8,745	6,734	7,145	8,947	5,638	1,385
4,287	3,857	1,389	1,378	3,785	2,938	3,847	5,748
3,159	3,756	1,048	4,582	1,482	5,647	2,947	9,283
8,937	9,283	4,873	1,375	6,628	9,283	5,647	6,743
4,278	4,756	2,126	8,145	1,385	6,473	3,847	9,827
1,385	2,847	4,111	6,137	1,748	6,758	3,892	7,465
6,734	1,478	8,148	4,973	3,362	4,637	5,648	7,485
7,836	7,831	8,375	1,375	3,785	1,384	4,635	3,847
9,456	3,279	1,375	9,725	9,837	9,726	2,938	5,647

2.

a	*b*	*c*	*d*	*e*	*f*	*g*	*h*
8,356	9,834	9,316	5,831	5,748	5,167	2,938	4,158
9,283	4,278	7,823	9,415	1,378	5,748	8,392	3,482
1,478	1,582	1,287	4,837	7,745	1,483	5,647	3,128
5,613	9,528	1,476	9,274	8,364	9,625	3,847	2,321
9,356	4,735	5,614	1,457	5,354	7,846	4,583	5,661
7,649	9,256	7,215	8,765	8,238	3,264	1,483	3,869
5,167	4,175	8,475	2,736	1,574	1,475	9,137	9,384
7,395	3,441	6,748	5,647	9,536	9,147	5,746	8,956
4,576	3,857	6,364	9,375	1,574	5,713	3,847	1,478

3.

a	*b*	*c*	*d*	*e*	*f*	*g*	*h*
7,345	5,893	7,458	5,784	7,483	5,476	5,473	6,487
8,246	6,587	5,673	8,473	5,674	5,352	6,432	6,837
2,564	4,523	9,375	6,432	8,345	8,957	8,574	7,452
4,985	7,993	8,475	8,947	7,745	2,147	9,847	3,564
6,347	5,893	2,649	2,433	7,894	4,675	6,453	5,748
7,763	3,574	4,356	5,372	8,564	7,436	7,574	4,376
8,392	2,323	5,938	7,465	6,463	8,948	8,235	4,785
4,675	8,213	6,422	9,376	4,563	4,574	6,574	3,287
4,756	8,493	7,478	8,584	3,289	6,463	7,463	7,483
6,354	5,783	6,934	3,857	9,521	6,483	9,487	5,475
5,837	6,489	5,134	6,542	5,473	8,984	5,674	2,376
5,374	8,945	5,842	8,475	8,234	5,326	4,837	6,473

EXERCISE No. 15, ADDING THE TENS COLUMNS FIRST

When adding a column of figures consisting of numbers of only two figures, the tens column may be added first. In other words, each amount in the tens column is considered as an equal number of tens, and when these are added, the amounts in the units column are added to them.

The following problems provide oral practice in applying this method. In the first column at the left, the process would be: 10 plus 60 is 70, plus 9 is 79, plus 7 is 86.

1.

a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*
67	75	29	35	72	37	26	19	88	36	67	23
19	38	15	65	18	24	37	71	15	25	84	78

2.

a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*
38	78	82	45	82	75	47	78	92	27	73	83
12	46	84	25	84	26	86	63	13	16	78	83

3.

a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*
73	47	27	47	83	47	67	92	48	58	58	48
56	85	73	93	72	82	13	14	72	47	39	39

4.

a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*
57	38	55	38	89	48	83	91	38	28	38	38
36	48	37	27	47	23	45	12	46	37	29	48

5.

a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*
51	48	39	57	39	29	51	93	58	48	92	82
38	39	13	39	15	47	38	25	42	16	15	16
92	68	46	15	56	15	15	16	74	92	73	27

6.

a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*
74	48	39	15	92	81	67	28	92	36	91	74
36	73	85	45	32	34	12	36	14	12	32	34
92	95	27	78	89	52	42	75	56	78	74	16

7.

a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*
15	67	46	28	82	85	17	75	67	64	94	84
63	18	82	37	14	78	84	14	24	67	16	37
84	82	16	46	14	15	86	86	94	85	82	13
92	47	92	54	18	68	54	56	14	45	64	82
17	92	19	18	72	47	82	92	75	63	46	28

EXERCISE No. 16, MONEY COLUMNS

The following problems provide written practice in adding money columns. Show on tablet paper the totals of each column by either method illustrated in Exercise No. 12.

The process of addition where dollars and cents are involved is the same as when adding abstract numbers. Cents must be kept in line with cents and dollars with dollars in the order of their unit value.

1.

a	*b*	*c*	*d*	*e*	*f*
$10.79	$18.42	$ 1.23	$49.15	$13.26	$46.50
2.18	.75	.94	.37	1.50	.98
1.62	1.60	6.17	2.45	9.75	1.00
19.10	.57	9.18	21.16	4.80	9.50
.32	9.63	10.10	3.40	28.75	15.50
1.51	8.70	9.16	.84	1.12	7.56
.08	.15	.13	17.20	8.75	.45
63.07	96.24	3.21	46.35	.05	1.75
14.26	9.63	9.46	12.54	87.50	71.25
12.39	17.27	98.45	22.75	1.39	1.72

2.

a	*b*	*c*	*d*	*e*	*f*
$ 7.45	$23.10	$ 1.98	$17.06	$ .03	$48.56
32.85	.05	10.14	23.50	23.94	.32
.92	4.50	1.75	3.15	12.39	9.63
46.67	91.52	8.45	2.35	9.63	10.11
1.34	13.07	1.76	2.15	18.20	3.40
.02	.41	1.50	37.26	1.39	28.74
14.91	8.00	25.50	18.20	61.04	1.16
14.76	.25	7.50	39.47	.10	71.83
3.34	.45	4.23	14.50	1.37	5.03
.17	19.75	1.57	16.53	73.48	30.00

3.

a	*b*	*c*	*d*	*e*	*f*
$45.23	$14.89	$49.90	$25.75	$ .95	$ 1.65
1.93	4.50	.09	41.63	34.15	41.45
5.05	49.90	4.50	44.42	4.23	28.42
45.50	8.16	6.35	9.35	23.48	42.68
16.53	.93	18.25	.02	9.57	6.75
93.47	4.75	9.31	1.50	5.75	.75
91.00	34.92	5.79	23.45	25.35	39.95
3.50	9.45	15.31	94.35	95.50	3.25
.50	93.76	23.42	1.50	4.72	13.89

CHAPTER III

PROOF OF ADDITION

The purpose of this chapter is to explain and illustrate some of the methods that may be utilized for proving addition. The definition of addition contemplates correct results because it requires the sum of two or more numbers. When you are adding a column of figures you are naturally interested in knowing that the sum is correct. The methods of proof discussed in this chapter are in the order of their importance.

EXERCISE No. 17, PROOF BY REVERSE ADDITION

In Exercise No. 3 you were advised to add from the bottom to the top but told that the results would be the same if the addition was from top to bottom. This means that when the addition of a column of figures is completed by the process of adding from the top to bottom, the columns would be re-added from bottom to top. The process of doing this and checking the results is explained in the illustration below.

17642 √26
97868 √26
44591 √33
92865 √29
13427 √23

√266393

The sum of the figures in the units column (23) adding from top to bottom is written at the right of the bottom amount; the sum of the figures in the tens column including the 2 carried from the units column (29) is written above the sum of the units column; in the same manner the hundreds, thousands, tens of thousands are added, the amount carried being included in each addition. The sum of all the numbers is 266,393 which is equivalent to reading the top number and the units digits in the totals column. The check mark (√) indicates that the columns have been re-added and the sum of each is correct. If when re-adding, the sum of a column is not the same by the second addition as the first, it is necessary to continue to re-add until the two are the same. The addition is completed by one process before checking by reverse addition.

The problems on page 27 provide written practice in adding and proving the results as illustrated and explained above. You

are to show on tablet paper (a) the total of each column with the excesses carried, and (b) proof of the addition by a check mark at the left of the total of each column.

a	*b*	*c*	*d*	*e*	*f*
65,291	95,243	42,961	37,925	75,689	92,543
34,296	17,845	30,542	59,821	49,100	17,762
59,783	85,391	59,672	20,076	81,047	69,043
45,574	27,956	68,734	47,372	52,165	22,598
67,523	70,123	75,643	19,372	48,623	34,256
33,756	36,824	90,179	65,033	21,809	76,895
95,273	68,462	22,981	96,751	40,675	26,174
76,754	45,980	37,549	71,023	39,172	55,167

EXERCISE No. 18, PROOF BY REVERSE ADDITION

In the preceding exercise the sum of each column was written at the right and the amount carried by mental process. If desired the amount to be carried may be written at the top of the column and included in the addition of the column. This process is illustrated below.

√√√√
2322
17642
97868
44591
92865
13427
266393

The figures in the units column are added from bottom to top, the 3 written under the line and the 2 written at the top of the tens column. The figures in the tens column are added, the 2 carried and written at the top, being included in the total of the column which is 29; the 9 is written as the tens in the sum and the 2 carried written above the hundreds column. The same plan is followed in adding the other columns. The check mark above each column indicates re-addition and proof.

The following problems provide written practice in adding and indicating the amount to be carried as illustrated above. Write the sum, amount carried and check marks as proof.

a	*b*	*c*	*d*	*e*	*f*
28,735	76,543	22,154	76,253	31,754	31,416
39,601	20,174	39,701	90,125	27,590	29,847
77,825	37,592	51,579	85,704	20,016	37,645
43,526	52,164	26,438	44,123	49,385	55,102
90,285	31,756	99,753	78,991	75,309	60,813
21,746	27,539	78,522	21,375	21,804	82,148
37,059	98,076	54,876	45,804	37,512	78,695
98,462	54,163	77,145	39,567	28,543	41,906

EXERCISE No. 19, PROOF BY REVERSE ADDITION

If desired, the sum of each column may be written so that these sums may be added to obtain the sum of the numbers. When this plan is followed the excess tens, hundreds, etc., are not carried and a check mark is written at the left of the sum of each column to indicate proof of addition.

7642	The sum of the figures in the units column is written at the right; the sum of the figures in the tens column, without carrying, is written below the sum of the figures in the units column and at the left; the same plan is followed in adding the figures in the other columns. The sum of the five numbers is the sum of the units, tens, hundreds, etc. columns. The check marks at the left show re-addition and proof.
7868	
4591	
2865	
√16	
√25	
√27	
√20	
√22966	

The following problems provide written practice in adding and indicating the totals of each column as illustrated above. You are to show on tablet paper (a) the sum of each column arranged as in the illustration, (b) the sum of these sums, and (c) the check marks at the left to indicate re-addition and proof.

1.

a	*b*	*c*	*d*	*e*	*f*
45,239	59,837	31,697	92,873	34,691	22,145
37,865	21,784	43,501	47,321	12,978	39,864
90,746	40,976	70,463	19,843	50,013	52,017
76,904	35,791	99,443	40,125	49,678	49,176
32,175	24,680	27,756	72,591	85,049	67,589
95,483	97,531	34,527	87,645	76,142	61,678

2.

a	*b*	*c*	*d*	*e*	*f*
66,349	20,981	88,645	31,802	64,178	22,198
40,581	34,896	40,826	75,184	45,019	34,567
75,491	15,135	41,389	44,510	65,233	32,415
27,116	19,763	65,482	31,709	31,746	98,765
34,763	43,579	91,534	16,718	41,578	12,345
56,708	74,350	64,351	34,902	29,713	19,005

EXERCISE No. 20, PROOF BY CHECK FIGURE NINE

A *check figure* is one which, when eliminated from each number to be added and from the sum, provides a key number that will prove the addition. *Nine* and *eleven* are used most frequently as check figures. The use of nine is illustrated below.

742583	= 29 =	11 =	2
52425	= 18 =	9 =	0
3155	= 14 =	=	5
126	= 9 =	=	0
38527	= 25 =	=	7
24004	= 10 =	=	1
752642	= 26 =	=	8
750	= 12 =	=	3
1824	= 15 =	=	6
250000	= 7 =	=	7
1866036	= 30 =	3	39 = 3

The illustration at the left shows the method of proving addition through the elimination of the 9's. To eliminate the nines from a number (a) divide by 9, or (b) add the digits in the number. The mental process of eliminating the nines in the first number is as follows: "7+4+2+5+8+3=29; 2+9=11; 1+1=2." The same mental process is followed with each number to be added and with the sum. The remainders after eliminating the nines of each number are added and the digits in this sum added. Referring to the illustration you will observe that the key figure "3" is the same in both the sum of the numbers and the sum of the remainders in each number after eliminating the nines. While the nines may be eliminated from a number by dividing the number by nine, the quicker process is to add the digits as illustrated.

The following problems provide written practice in adding and proving the addition by the use of the check figure nine. Arrange your work in the same order as in the illustration except it will not be necessary for you to copy the figures in the problems.

a	*b*	*c*	*d*	*e*	*f*
23,497	67,623	23,109	76,348	20,146	37,987
5,634	5,987	175	52,901	59,738	4,231
976	437	4,586	6,754	35,764	103
70,891	35,291	366	3,633	4,018	92,053
4,795	2,770	98,421	771	375	2,298
374	143	5,294	398	421	509
87,924	74,126	637	7,520	5,890	14,450
4,762	8,214	85,729	1,098	91,243	7,765
352	952	4,013	36,217	76,021	371

EXERCISE No. 21, PROOF BY CHECK FIGURE ELEVEN

The illustration on page 30 shows the process of proof when the elevens are eliminated from each number to be added and from the sum. You will observe the process of arriving at the key

figure is different from that illustrated in the preceding exercise, but the use of the key figure is the same.

742583	12 = 23 − 17 =	6
52425	14 = 14 − 4 =	10
3155	6 = 17 − 8 =	9
126	7 = 7 − 2 =	5
38527	15 = 15 − 10 =	5
24004	6 = 6 − 4 =	2
752542	12 = 23 − 13 =	10
750	7 = 7 − 5 =	2
1824	12 = 12 − 3 =	9
250000	5 = 5 − 2 =	3
1865936	= 22 − 16 = 6	61 = 6

The illustration at the right shows the method of proving addition by eliminating the 11's. The elevens may be eliminated from the number (a) through dividing by 11, or (b) by adding the digits in the odd places beginning at the right and the digits in the even places beginning at the right, and subtracting the sum of the even from the sum of the odd; if the sum of the digits in the odd places is less than that of the even, add 11 or a multiple of 11 so that the subtraction is possible. The mental process of eliminating the elevens in the first number in the illustration is as follows: "3 + 5 + 4 = 12; 8 + 2 + 7 = 17; 12 + 11 = 23; 23 − 17 = 6." Here the sum of the digits in the odd places is less than the sum of the digits in the even places, hence it is necessary to add 11 before subtracting. The same mental process is applied in eliminating the elevens from the second and third numbers. In the fourth number the mental process is "6 + 1 = 7; 7 − 2 = 5."

Eliminating the elevens from the sum and from the sum of the remainders provides the same key figure, "6", hence the addition is correct.

The following problems provide written practice in adding and proving the addition by the elimination of elevens. You will arrange your work on tablet paper in the same form as the illustration, except you need not copy the figures to be added.

a	*b*	*c*	*d*	*e*	*f*
39,582	45,201	31,507	75,591	98,103	66,733
74,730	2,098	62,543	20,148	3,514	21,437
16,029	765	5,170	82,146	952	6,274
4,827	14,380	2,168	5,910	50,147	3,156
367	5,601	402	987	3,217	307
359	225	517	674	758	221
3,875	77,189	3,214	3,819	43,761	3,198
75,103	4,571	5,764	37,165	3,758	2,468
87,549	367	98,473	84,307	324	91,406

NOTE: Either the check figure nine or eleven will prove the addition of an independent column, but when the numbers are copied in separate records, the check figure nine will not detect errors in transposed figures. Since the check figure eleven will detect errors in transposed figures, it is considered the better one to use.

EXERCISE No. 22, VERTICAL AND HORIZONTAL ADDITION

Vertical and *horizontal addition* refers to the adding of two or more separate columns vertically and horizontally to prove the correctness of all additions. The problem below and its solution illustrates the application of this method.

$$\begin{array}{r} 2+\ 7+\ 3+\ 5+\ 6+\ 9=\ 32 \\ 4+\ 3+\ 7+\ 8+\ 6+\ 3=\ 31 \\ 2+\ 7+\ 9+\ 4+\ 8+\ 5=\ 35 \\ 5+\ 4+\ 3+\ 6+\ 8+\ 2=\ 28 \\ \hline 13+21+22+23+28+19=126 \end{array}$$

Each column is added horizontally and vertically. The sum secured by the vertical addition is written under each column, and by the horizontal addition at the right of each column. The process of addition should be from bottom to top for the vertical and from left to right for the horizontal. The proof is effected by adding the totals at the bottom horizontally, and the totals at the right vertically.

The following problems provide written practice in proof of addition through vertical and horizontal addition. You will show on tablet paper the totals obtained by adding vertically and horizontally and the proof through the addition of these totals.

1

$$\begin{array}{r} 2+9+4+7+8+3+9=? \\ 8+4+3+8+5+7+3=? \\ 4+2+7+4+6+4+5=? \\ 1+3+7+4+7+3+7=? \\ 9+4+6+3+6+9+6=? \\ 7+2+3+5+8+2+3=? \\ 7+8+4+9+6+3+8=? \\ 6+5+3+8+9+5+6=? \\ \hline ?+?+?+?+?+?+?=? \end{array}$$

2

$$\begin{array}{r} 7+4+7+4+8+2+4=? \\ 1+4+6+3+7+2+6=? \\ 2+4+5+3+3+4+9=? \\ 4+7+2+7+4+6+3=? \\ 9+6+7+4+3+7+2=? \\ 1+4+3+6+7+3+5=? \\ 4+7+5+6+8+7+9=? \\ 5+7+4+6+8+2+3=? \\ \hline ?+?+?+?+?+?+?=? \end{array}$$

3

$$\begin{array}{r} 5+6+5+7+4+3+5=? \\ 6+4+7+8+2+9+6=? \\ 3+6+4+5+7+5+3=? \\ 5+3+7+4+6+7+4=? \\ 8+4+5+6+7+3+6=? \\ 9+6+7+8+8+2+8=? \\ 4+5+6+7+3+2+2=? \\ 6+5+4+3+7+8+5=? \\ \hline ?+?+?+?+?+?+?=? \end{array}$$

4

$$\begin{array}{r} 4+6+5+7+8+9+7=? \\ 5+9+8+7+4+2+9=? \\ 1+4+2+3+6+8+3=? \\ 4+7+5+6+7+9+5=? \\ 3+6+4+4+3+6+8=? \\ 5+3+7+4+5+6+4=? \\ 2+1+3+3+5+4+2=? \\ 3+6+9+3+4+7+6=? \\ \hline ?+?+?+?+?+?+?=? \end{array}$$

5. The Model Laundry has 5 drivers who collect and deliver laundry. During the week beginning January 9, they collected cash as listed below.

	M	*T*	*W*	*T*	*F*	*S*	
Jones	$26.50 +	$27.85 +	$35.40 +	$24.16 +	$18.54 +	$52.98	= ?
Davis	21.19 +	25.32 +	31.48 +	25.04 +	17.36 +	51.18	= ?
Brown	28.11 +	25.15 +	33.65 +	27.92 +	15.81 +	55.45	= ?
Dooley	20.25 +	32.85 +	14.62 +	31.18 +	22.65 +	55.87	= ?
Ray	24.14 +	38.19 +	27.62 +	22.09 +	19.87 +	49.23	= ?
	? +	? +	? +	? +	? +	?	= ?

Ascertain: (a) the total amount of cash collected each day; and (b) the total amount collected by each driver. Prove by vertical and horizontal addition.

EXERCISE No. 23, COPYING FIGURES

Copying figures correctly is equally as important as adding correctly, because if incorrectly copied, the sum will be incorrect even though the process of addition were correctly applied.

The following problems provide written practice in: (a) copying figures; (b) addition; and (c) proof of addition.

1. Copy each of the following columns on a sheet of paper, add, and prove by the check figure 9. Arrange your work as in the illustration of check figures on page 29.

a	*b*	*c*	*d*	*e*	*f*	*g*	*h*
326	726	317	174	428	942	715	257
432	398	243	316	747	163	168	533
515	407	815	175	215	206	206	956
679	259	912	815	164	721	721	128
248	117	748	994	928	832	832	314
143	243	463	375	314	415	415	725

2. Copy each of the following columns on a sheet of paper, add, and prove by the check figure 11.

a	*b*	*c*	*d*	*e*	*f*	*g*	*h*
517	249	752	321	213	613	234	158
861	424	944	234	431	132	311	206
912	375	407	231	524	235	532	891
383	242	367	423	413	443	131	185
559	573	134	435	213	214	321	215
602	703	357	342	321	312	212	112

3. Copy each of the following columns on a sheet of paper, add and prove by reverse addition.

a	*b*	*c*	*d*	*e*	*f*	*g*
124	431	231	412	1,244	4,213	3,124
216	513	431	134	3,152	2,531	5,113
341	142	424	244	3,541	4,315	1,234
234	353	321	123	1,124	1,241	6,725
261	425	212	125	3,225	3,632	1,043
514	112	324	412	6,321	4,016	2,120
315	126	124	351	1,232	6,521	3,216
442	451	242	113	1,525	1,234	5,451
312	332	134	142	5,342	2,245	2,320

EXERCISE No. 24, CALLING NUMBERS

When it is necessary to call numbers, two persons are involved, one to call, and one to make the record of the numbers called. A code should be established to facilitate rapid calling and correct interpretation. Thus, if the amount to be called is 1,645, it would require too much time to read this as one thousand six hundred forty-five. Sixteen hundred forty-five would be sufficient information for the writer and he could call back one six four five. The person writing the figures should call them back so that the reader may know he has correctly interpreted them. Each may use the same code, but it is better to use a different one. The illustrations below will suggest a code for calling figures:

1,645 is read sixteen hundred, forty-five,
and called back one, six, four, five.

10,675 is read ten thousand, six hundred seventy-five
and called back one, naught, six, seven, five.

$12.80 is read twelve dollars eighty cents
and called back twelve point eighty.

$1,280 is read twelve hundred eighty dollars
and called back one, two, eight, naught, dollars.

$200.60 is read two hundred dollars sixty cents
and called back two hundred point sixty.

138,460 is read one thirty-eight four sixty
and called back one, three, eight, four, six, naught.

NOTE: If the figures called all relate to dollars and cents, it is not necessary to designate this each time, hence time can be saved when calling.

The figures in the following columns provide practice in calling numbers, writing figures, calling back, and adding. Prove the addition of each problem.

a	*b*	*c*	*d*	*e*
$5,807.63	$142,780.67	$958,324.55	454,394	354,283,496
1,807.49	1,356.50	34,432.25	34,565	45,921,003
933.61	33,734.35	420.01	231,495	1,354,211
21.00	42.92	3,529.00	1,599	716,752,498
9,910.86	1,329.52	10.00	10,050	45,007
746.84	92,423.75	342,537.19	501,345	4,710,903
1.64	3,000.02	31,563.91	595	4,057
8,327.50	837,703.50	989,768.92	14,678	455,942,405
427.43	745,324.15	78,000.10	983,435	4,032,001
73.00	4,389.59	1,002.05	3,234	45,647,810
1,502.67	345,103.22	101,563.02	375,641	32,445,108
39.14	37,656.15	1.25	42,107	1,675,890

EXERCISE No. 25, PAY ROLLS

Factory employees are usually paid weekly. The information regarding the amount due each employee is obtained from a record of his time maintained in the accounting department. It is necessary for the paymaster to know on pay day (a) the amount due each employee, (b) the total amount necessary to pay all employees, and (c) the change necessary to make up the pay roll so that the amount due each employee may be inclosed in an envelope ready to hand to him.

The following problems provide written practice in ascertaining the information needed by the paymaster. You are not required to record the time because this involves bookkeeping.

1. The Brown Manufacturing Company employs twelve employees in one department of its factory. The pay-roll sheet on page 35, shows the daily earnings of each employee. You are required to ascertain (a) the amount due each employee by horizontal addition, (b) the total amount of the daily pay roll by vertical addition, (c) the proof of this amount, and (d) the change necessary to place the amount due each employee in an envelope.

Name	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.	Total
Brown	6.37	7.45	6.25	6.75	6.00	6.47	
Clark	5.95	5.45	6.25	5.89	5.79	5.73	
Davis	6.75	6.95	6.55	6.34	6.47	6.50	
Ellis	7.00	7.25	7.45	6.95	7.43	7.59	
Ely	5.78	5.85	5.48	5.15	5.98	6.50	
French	7.35	7.25	6.89	6.95	6.12	5.59	
Garrett	6.89	7.84	7.57	7.24	7.18	7.31	
Howard	5.45	5.68	5.79	5.85	5.95	5.79	
Innes	7.35	7.47	7.61	7.83	7.98	7.55	
Jones	6.47	6.63	7.05	6.95	6.47	6.59	
King	5.89	5.74	6.47	6.53	6.63	6.51	
Miller	6.21	6.36	6.63	6.55	6.37	6.49	
TOTAL							

The method of ascertaining the correct amount of change due each employee is illustrated below.

Amount	20's	10's	5's	2's	1's	50c	25c	10c	5c	1c
39.29	1	1	1	2			1			4
35.06	1	1	1						1	1
39.56	1	1	1	2		1			1	1

The illustration shows the amount due the first three employees. You will observe that columns are provided for the amount due each employee and the various denominations of currency and change. On a line with the amount due each employee is indicated the number of pieces necessary to pay the employee, using the least possible number of pieces.

2. The Union Manufacturing Company had fifteen employees. The pay roll for the week ending January 9 is as follows:

Name	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.	Total
White	10.22	9.78	11.17	9.66	9.83	9.17	
Donley	9.57	10.19	8.73	9.78	8.89	9.45	
Hayes	9.63	11.28	10.32	10.26	9.17	9.65	
Duggan	10.87	9.74	10.09	9.91	9.87	9.34	
Smith	8.98	12.98	10.16	10.52	8.76	9.32	
Ernst	9.15	10.51	10.37	10.23	9.75	9.27	
Evers	9.39	10.41	9.87	9.27	9.21	9.39	
Burns	7.99	11.85	9.34	9.73	10.79	9.71	
Kraus	10.78	8.23	9.17	9.88	9.43	9.99	
Fisher	12.13	7.41	9.39	9.76	8.17	9.79	
Grant	11.54	9.19	10.67	10.87	9.67	9.32	
Ebert	9.67	10.43	10.02	9.78	9.43	9.89	
Jones	11.91	8.34	10.18	10.15	10.76	9.78	
Miller	10.52	9.87	10.37	9.75	11.21	9.45	
Wade	11.83	8.15	9.45	8.17	10.67	9.86	
TOTAL							

You are to indicate on tablet paper (a) the amount due each employee, (b) the total daily wages, (c) the total due the fifteen employees at the end of the week, and (d) the number of pieces of each denomination of money required to make up the pay roll.

3. The Central Garage employs six men in its repair department. Each man keeps a record of his time on a card, this record being checked with the time-clock and the charge sheets for repair work. The amount due each employee from the card records for the week ending Saturday, May 14, is as follows:

James Moore, Monday $7.60, Tuesday $8.80, Wednesday $9.75, Thursday $9.87, Friday $8.97, Saturday $9.45; John Brown, Monday $7.75, Tuesday $8.85, Wednesday $9.85, Thursday $9.95, Friday $8.75, Saturday $7.75; Ray Whitney, Monday $8.85, Tuesday $9.45, Wednesday $9.65, Thursday $8.95, Friday $7.75, Saturday $8.80; Don Clark, Monday $8.85, Tuesday $9.25, Wednesday $9.75, Thursday $8.75, Friday $9.50, Saturday $8.95; Harry Miller, Monday $9.75, Tuesday $8.85, Wednesday $7.95, Thursday $9.87, Friday $8.68, Saturday $9.56; Frank Smith, Monday $8.87, Tuesday $8.95, Wednesday $9.53, Thursday $9.78, Friday $8.98, Saturday $9.75.

You are required (a) to rule a form similar to that in problem 1 and arrange the names of the employees and the amounts due each in the same manner, (b) to ascertain the amount due each employee on pay day, (c) the total amount necessary to make up the pay roll, and (d) the change required by the paymaster to pay each employee.

EXERCISE No. 26, RECEIVING AND SHIPPING MERCHANDISE

The following problems provide written practice in applying addition to the solution of some of the problems encountered in receiving and shipping merchandise. You are to show on tablet paper the information desired.

1. March 7, Brown Brothers, manufacturers of men's clothing, received an order from A. L. Day, one of their customers. This order was referred to the shipping clerk with instructions to pack in cases and give the office a statement of the weights in each case. After packing the merchandise ordered, the shipping clerk reported that it required twelve cases to contain the merchandise. These cases were numbered in regular order beginning with one and the weights reported as follows: 256 lbs., 319 lbs., 408 lbs., 271 lbs., 400 lbs., 353 lbs., 455 lbs., 485 lbs., 316 lbs., 389 lbs., 412 lbs., 487 lbs. Assuming that the cases are numbered in the order in which the weights are given, show on tablet paper the number and weight of each case and the total weight. Prove by reverse addition.

2. The Jones Mercantile Company received a consignment of merchandise contained in ten cases. The total weight of these cases as shown on the bill of lading was 1,886 pounds. The weight of each case in pounds shown on the invoice was as follows: 199, 156, 142, 237, 219, 86, 155, 181, 148, and 263. You are to list the

weights on tablet paper, add, and show by the elimination of nines that your total is correct.

3. Robert Decker delivered ten truck loads of wheat to an elevator. The net weight in pounds of the wheat in each truck was as follows: 4,165, 4,221, 3,962, 4,144, 4,355, 3,998, 4,455, 4,687, 4,563, and 4,471. List these weights on tablet paper, and ascertain the total weight of wheat delivered.

4. James Dodson delivered to Brown Commission Co., twenty-five bags of potatoes, weights, in pounds as follows: 125, 119, 121, 115, 124, 117, 122, 116, 123, 118, 121, 115, 118, 125, 119, 124, 122, 117, 116, 123, 115, 119, 125, 117, and 122. List these weights, add, and prove by the check figure eleven.

5. J. W. Dillman delivered to a cannery twelve truck loads of green corn, weights, in pounds, as follows: 3,756, 3,942, 4,291, 4,372, 4,150, 3,890, 3,650, 4,097, 4,400, 3,854, 3,905, and 4,321. List these weights, add, and prove the sum by reverse addition.

EXERCISE No. 27, SALES MANAGERS' PROBLEMS

A sales manager has charge of sales and of those who make the sales. The following problems relate to sales and expenses of salesmen.

1. The Davis Manufacturing Company employs five traveling salesmen each of whom reports his weekly expenses at the end of the week. The following are the expenses for each of these salesmen during thirteen weeks beginning January first.

Date	*Ray*	*Day*	*May*	*Lay*	*Kay*
January 7	$67.89	$75.80	$62.50	$84.79	$76.77
January 14	7.25	67.89	75.50	78.54	68.90
January 21	75.98	81.45	80.45	72.43	83.45
January 28	67.50	73.56	83.29	67.89	70.21
February 4	83.45	84.56	77.22	75.49	75.76
February 11	74.50	6.54	68.75	62.45	79.80
February 18	65.43	83.67	72.75	74.56	82.34
February 25	78.95	79.80	70.89	77.86	7.50
March 4	73.45	80.75	81.76	83.45	80.98
March 11	62.34	77.87	65.78	65.89	65.90
March 18	69.70	61.89	74.96	9.25	77.75
March 25	84.39	65.40	69.70	67.80	68.40
April 1	81.70	82.43	7.65	84.35	82.90

Show on tablet paper (a) the horizontal addition with the information it shows, (b) the vertical addition with the information it shows, and (c) the final totals and proof.

2. The Sales Manager for the Kroger Grocery Company wishes to know the total sales made by each of the six traveling salesmen employed by the firm during the first six months of the year, also the total sales of all the six salesmen for the same term. These sales are recorded in the books of the company as follows: J. O. Richards, $551.65, $423.38, $647.27, $675.42, $582.26, and $743.25; Louis Garrison, $789.45, $675.25, $725.31, $752.47, $712.46, $863.22; R. T. Welch, $864.33, $784.22, $792.23, $825.89, $789.95, $835.42; C. T. Gray, $646.25, $595.29, $651.94, $642.24, $603.33, $755.11; John Hume, $932.49, $764.48, $827.72, $832.46, $789.72, $843.68; T. B. Wood, $865.22, $798.63, $825.26, $851.82, $846.88, $875.50. Arrange these figures on tablet paper so that you can show the facts desired and prove by vertical and horizontal addition.

3. The sales report for the Pleasant View Dairy during the twelve months beginning with January shows the following monthly sales of butter, cream, certified milk, sweet milk, and buttermilk.

Month	*Butter*	*Cream*	*C. Milk*	*S. Milk*	*B. Milk*
January	$175.46	$278.95	$98.75	$248.90	$69.50
February	179.75	295.35	89.25	239.45	57.65
March	164.55	265.47	85.65	245.39	74.80
April	189.76	235.90	64.34	237.56	70.10
May	192.45	256.78	78.90	225.49	44.50
June	155.90	249.55	55.50	215.48	53.24
July	158.75	229.85	69.89	210.56	62.45
August	176.89	239.55	72.34	206.57	66.67
September	179.87	289.76	80.15	229.65	55.19
October	195.67	298.75	95.67	234.90	72.68
November	186.50	281.65	99.21	241.35	59.85
December	199.45	273.66	92.35	249.15	71.62

You are to show on tablet paper (a) the total value of each product sold during the year, (b) the total value of all products sold during each month, and (c) the total of all products sold during the year.

CHAPTER IV

SUBTRACTION

The purpose of this chapter is to provide practice in subtraction, and proof of the difference. The explanation and problems are given under the assumption that you understand the mathematical principles involved in the process of subtraction.

Subtraction is the process of finding the difference between two numbers. The number to be diminished is the *minuend.* The number subtracted is the *subtrahend.* The result obtained in subtraction is known as the *difference,* the *balance,* or the *remainder.*

EXERCISE No. 28, SUBTRACTION

The purpose of the following problems is to provide oral practice in determining the difference between two numbers of one or more figures. With practice you can learn to read numbers and subtract them as rapidly as you can read combinations in addition.

Subtraction is a process of addition. Thus, in the first problem, you are required to subtract 3 from 6, which is equivalent to adding 3 and 3. You should prove all subtraction by adding the difference to the subtrahend.

1.	6	5	8	7	5	9	4	3	8	6	5	9
	3	2	4	5	2	3	3	2	5	2	4	7
2.	17	14	17	16	18	15	19	12	16	13	19	15
	6	3	4	5	4	3	7	2	5	2	8	4
3.	19	16	18	14	12	16	18	14	17	14	18	13
	13	10	14	12	10	14	17	13	12	12	16	11
4.	25	28	35	27	36	39	27	24	37	28	24	35
	22	26	34	22	33	25	23	21	31	25	21	32

(*Exercise No. 28—Continued from page 40*)

5.	38	49	36	28	37	47	53	58	28	35	39	49
	26	36	22	16	23	33	31	35	15	11	16	23
6.	35	29	47	67	36	28	47	46	27	38	24	57
	23	22	31	33	24	13	24	13	15	24	11	35
7.	38	29	47	68	89	58	49	67	88	49	97	95
	13	11	23	25	47	24	16	24	36	26	43	62
8.	68	35	57	89	49	37	36	57	39	69	45	42
	49	37	28	49	36	29	18	29	35	21	57	28

EXERCISE No. 29, SUBTRACTION AND PROOF

The purpose of this exercise is to provide written practice in subtraction. Each problem should be proved by addition as explained on page 40. Place a sheet of paper under each problem, subtract, write the difference on this sheet and prove by adding the difference to the subtrahend. Place a check mark at the left of each difference to indicate the proof.

	a	*b*	*c*	*d*	*e*	*f*	*g*
1.	478	$7,847	59,847	$587.46	584,736	$4,564.35	483,766
	127	5,849	48,372	376.28	483,769	2,736.58	138,476
2.	*a*	*b*	*c*	*d*	*e*	*f*	*g*
	983	$5,838	84,736	$837.47	685,746	$8,475.67	685,746
	595	2,876	27,365	574.38	328,746	3,837.37	451,678
3.	*a*	*b*	*c*	*d*	*e*	*f*	*g*
	938	$7,839	58,473	$587.48	857,463	$2,837.57	685,743
	473	3,765	47,362	384.37	584,736	1,476.38	415,876
4.	*a*	*b*	*c*	*d*	*e*	*f*	*g*
	634	$8,473	84,937	$587.39	584,736	$5,847.84	796,854
	489	6,857	57,438	513.28	293,874	1,345.68	148,376
5.	*a*	*b*	*c*	*d*	*e*	*f*	*g*
	529	$9,721	56,723	$365.27	697,642	$4,923.15	620,713
	385	3,498	34,962	198.75	576,333	2,168.75	396,752

EXERCISE No. 30, PROOF OF SUBTRACTION

When it is desired to ascertain the sum of the differences between two or more numbers, the proof may be effected by combining addition and subtraction as illustrated below. This illustration shows the solution and proof of the problem 34,256 − 13,475 and 67,483 − 37,485.

a	*b*	*c*
34,256	67,483	20,781
13,475	37,485	29,998
20,781	29,998	50,779
d	*e*	*f*
34,256	13,475	101,739
67,483	37,485	50,960
101,739	50,960	50,779

Solutions (a) and (b) at the left show the subtraction required in the problem; (c) shows the addition of the differences; (d) shows the addition of the minuends; (e) shows the addition of the subtrahends. The subtraction is proved to be correct when (c) the sum of the differences of the numbers equals (f) the difference between the sum of the minuends and the sum of the subtrahends. This method of proof is applied to subtraction and addition in connection with controlling accounts, a phase of accounting in the standard bookkeeping process.

The following problems provide written practice in applying proof of subtraction by combining the process with addition as illustrated above. Arrange your work on tablet paper the same as in the illustration, except you will have six groups of figures instead of two groups.

1.

a	*b*	*c*	*d*	*e*	*f*
$7,261.44	$624.25	$2,481.36	$642.39	$4,283.62	$286.24
5,271.30	271.33	1,987.81	489.27	3,762.28	175.56

2.

a	*b*	*c*	*d*	*e*	*f*
$9,762.35	$834.45	$5,839.46	$385.54	$6,598.84	$587.45
4,837.59	432.67	4,684.34	123.34	4,774.39	146.78

3.

a	*b*	*c*	*d*	*e*	*f*
$7,845.56	$898.39	$3,847.75	$348.87	$4,158.14	$534.82
6,734.84	248.47	3,538.88	145.64	2,938.12	246.88

4.

a	*b*	*c*	*d*	*e*	*f*
$8,495.56	$837.57	$5,748.38	$758.34	$5,748.34	$869.46
8,238.47	635.34	2,839.47	746.28	3,738.27	726.38

EXERCISE No. 31, SUBTRACTION UPSIDE DOWN

Subtraction is usually indicated by writing the smaller number under the larger one from which it is to be subtracted. Sometimes in business problems, the position is such that it is necessary to subtract the top number from the bottom number, because the bottom number is the larger.

The following problems provide written practice in subtraction when the figures are in the reverse position.

1.	*a*	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*
	82	17	84	51	57	82	79	73	71	93	87
	99	38	96	63	71	98	87	97	82	99	99
2.	*a*	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*
	15	16	33	40	81	16	19	13	16	19	7
	75	24	56	66	98	61	91	32	60	81	63
3.	*a*	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*
	18	15	75	37	18	26	57	33	17	13	15
	66	33	90	84	73	81	62	54	75	68	47
4.	*a*	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*
	73	21	66	45	27	32	37	93	76	17	46
	88	46	84	94	57	44	46	98	85	46	59

EXERCISE No. 32, SUBTRACTION BY ADDITION

The Austrian method of subtraction is made by adding to the smaller number a number which will make it equal to the larger number, the number added being the difference. The following problems provide oral practice in applying this method.

1.	9	7	4	8	5	8	7	6	9	9
	7	3	2	6	2	5	4	3	4	2
2.	18	14	15	19	13	19	17	18	14	18
	13	12	13	16	11	13	14	10	11	14
3.	38	39	47	57	32	68	48	69	38	57
	29	23	29	58	27	39	35	24	32	39
4.	42	54	65	45	63	47	32	67	41	56
	26	25	38	27	39	28	16	29	35	27

EXERCISE No. 33, SUBTRACTION BY ADDITION

The following problems provide written practice in applying the Austrian method of subtraction. Arrange your work on tablet paper as in the illustration.

Subtraction	*Explanation*
1235	6 and 9 are 15
−786	9 and 4 are 13
449	8 and 4 are 12

Unless you are accustomed to subtracting by the Austrian method, it will seem more difficult than the process of subtracting the subtrahend from the minuend. However, with practice, you will become more proficient, and it is claimed, more accurate through using this method.

	a	*b*	*c*	*d*	*e*
1.	4,375	21,847	$38,576.25	$45,287.37	$28,374.45
	283	3,146	2,873.48	2,837.79	4,726.28
2.	5,847	41,387	$83,746.88	$82,736.56	$73,846.26
	378	3,847	3,746.57	2,837.28	3,746.58
3.	8,572	41,587	$57,362.84	$38,473.32	$39,283.45
	398	6,453	4,857.68	9,485.86	3,847.38
4.	9,384	39,487	$57,382.25	$47,565.72	$48,372.21
	478	3,847	5,837.37	3,848.56	1,384.38

EXERCISE No. 34, RETROGRESSIVE SUBTRACTION

Retrogressive subtraction provides excellent practice in obtaining the difference between two numbers.

The following drill provides oral practice in retrogressive subtraction. You will subtract in each case until the remainder is equal to or less than the number to be subtracted.

1. Begin with 47 subtract by 2's; 4's; 6's; 8's
2. Begin with 92 subtract by 3's; 5's; 7's; 9's
3. Begin with 98 subtract by 5's; 7's; 9's; 3's
4. Begin with 78 subtract by 4's; 6's; 8's; 2's
5. Begin with 88 subtract by 3's; 5's; 7's; 9's
6. Begin with 64 subtract by 6's; 8's; 4's; 2's
7. Begin with 73 subtract by 5's; 7's; 3's; 9's
8. Begin with 96 subtract by 8's; 4's; 6's; 2's

EXERCISE No. 35, PROFIT AND LOSS

The profit or loss made through the purchase or sale of property is determined by subtraction, or addition and subtraction. If the purchase price and selling price are the only two amounts involved, the profit or loss is ascertained by subtraction. If a number of amounts are involved in connection with the cost, or the income, it is necessary to add them in order to ascertain the total cost or total income.

The following problems provide written practice in ascertaining the profit or loss resulting from the purchase and sale of specific property.

1. D. W. Cross purchased a farm of 160 acres for $16,000. January 25, he paid taxes, $225.50; February 12, he paid for repairing buildings and fences, $565.75; March 1, he sold the farm for $18,750. Show on tablet paper all the calculations necessary to ascertain his profit or loss on this farm.

2. May 10, A. L. Young paid $2,150 for an automobile. He kept it three years and then traded it in on another automobile, the purchase price of which was $2,575. He gave his old machine and $1,685.50 cash in payment for the new machine and accessories amounting to $135.50. Show on tablet paper the loss on the first automobile through its use for three years.

3. C. H. Martin was paying $60 monthly rent for his home. On April 1, he paid $8,575 for the property. July 1, he paid $427.50 for repairs and painting; December 31, he paid taxes $119.85 and insurance $75. On March 31, he sold property for $10,000. How much was his profit taking into consideration the rent which he would have paid had he not purchased the property?

4. A farmer paid $387.50 for hogs and sold them for $637.65. How much was his profit, if he spent $187.78 for feed?

5. C. C. Ming sold to a cannery the tomatoes grown on his farm for $987.45. How much profit did he make on this crop of tomatoes after deducting the cost of planting, $75.50; cultivating, $279.87; and gathering, $204.62?

6. O. H. Barclay began the chicken business, January 2, with one hundred chickens for which he paid $75. During the first six months of the year he sold eggs and chickens to the value of $137.55, and bought additional chickens for $75. How much was his profit, if the amount paid for feed was $42.38 and the value of the chickens on hand was $116.95?

RAILROAD TIME-TABLES

It is customary for the railroads to provide a time-table showing detailed information regarding all trains operated on each division of its roads. The time-table given below shows the schedule of trains on the Cincinnati Division of the Big Four Railroad.

Table No. 13 CINCINNATI TO INDIANAPOLIS AND CHICAGO

Miles	STATIONS Central Standard Time	15 Chicago Lim. Daily	19 White City Sp'c'l Daily	43 Chicago Exp. Ex. Sun.	31 Royal Palm Daily	35 Chicago Night Sp'c'l Daily	5 The Sycamore Daily	⊕1 Chgo. Mail and Exp. Daily	33 Ind-pls. Lim. Daily	27 Exp. Daily	
		AM	Noon	PM	PM	PM	PM	AM	PM	PM	
0	CINCINNATI..Lv	9 00	12 00	8 30	9 45	11 55		7 30	6 00	3 00	
17	Valley Jct.....“	.....	.....	.....	.....	.....		8 15	.....	.....	
22	Lawrenceburg Jc“	.....	.....	G 9 04	10 H17	.....		8 30	.....	3 35	
27	Guilford.....“	.....	.....	.....	.....	.....		8 40	.....	f 3 44	
31	Bonnell.....“	.....	.....	.....	.....	.....		8 46	.....	f 3 50	
36	Weisburg.....“	.....	.....	.....	.....	.....		8 59	.....	f 4 00	
39	Sunman.....“	.....	.....	.....	.....	.....		9 08	.....	4 10	
41	Spades.....“	.....	.....	.....	.....	.....		9 12	.....	4 13	
45	Morris.....“	.....	.....	.....	.....	.....		9 20	.....	4 20	
47	Batesville.....“	10 11	.....	9 42	10 H52	.....		9 26	.....	4 25	
54	New Point.....“	.....	.....	.....	.....	.....		9 37	.....	4 35	
58	McCoy.....“	.....	.....	.....	.....	.....		f 9 45	.....	J 4 42	
62	Greensburg.....“	10 35	1 26	10 05	11 12	1 14		10 00	7 25	4 55	
67	Adams.....“	.....	.....	.....	.....	.....		f10 11	.....	f 5 05	
72	St. Paul.....“	.....	.....	.....	.....	.....		10 19	.....	f 5 12	
75	Waldron.....“	.....	.....	.....	.....	.....		10 24	.....	f 5 16	
82	Shelbyville.....“	11 04	1 51	10 33	11 41	..Q..		10 43	7 49	5 29	
89	Fairland.....“	.....	E 2 01	.....	.....	.....		10 54	.....	5 40	
96	Acton.....“	.....	.....	.....	.....	.....		11 05	.....	f 5 50	
103	Beech Grove...“	.....	.....	.....	.....	.....		11 20	.....	.....	
109	IND'NAPOLIS Ar	11 50	2 35	11 20	12 25	2 25		11 45	8 30	6 20	
109	IND'NAPOLIS Lv	12 00	2 45	11 35	12 40	2 35	5 00	12 15	PM	PM	
120	Augusta.....“	.....	.....	.....	.....	.....	.....	12 35	.....	.....	
125	Zionsville.....“	.....	.....	.....	.....	.....	.....	12 42	.....	.....	
130	Whitestown.....“	.....	.....	.....	.....	.....	.....	12 51	.....	.....	
138	Lebanon.....“	.....	3 28	12 22	H11 31	.....	5 42	1 05	.....	.....	
143	Hazelrigg.....“	.....	.....	.....	.....	.....	.....	f 1 12	.....	.....	
147	Thorntown.....“	.....	3 40	12 38	H11 50	.....	.....	1 20	.....	.....	
153	Colfax.....“	.....	.....	.....	.....	.....	.....	1 30	.....	.....	
158	Clark's Hill.....“	.....	.....	.....	.....	.....	.....	1 40	.....	.....	
161	Stockwell.....“	.....	.....	.....	.....	.....	.....	1 44	.....	.....	
165	Crane.....“	.....	.....	.....	.....	.....	.....	f 1 58	.....	.....	
174	LAFAYETTE “	1 30	4 18	1 45	2 55	4 16	6 25	2 20	.....	.....	
192	Templeton.....“	.....	.....	.....	.....	.....	.....	2 52	.....	.....	
196	Atkinson.....“	.....	.....	.....	.....	.....	.....	f 2 59	.....	.....	
198	Swanington.....“	.....	.....	f 2 30	.....	.....	.....	3 04	.....	.....	
202	Fowler.....“	.....	5 02	2 40	H3 46	.....	.....	3 16	.....	.....	
209	Earl Park.....“	.....	5 13	2 54	H3 58	.....	.....	3 31	.....	.....	
211	Sheff.....“	.....	.....	.....	.....	.....	.....	f 3 37	.....	.....	
214	Raub.....“	.....	.....	f 3 01	H4 08	.....	.....	3 43	.....	.....	
219	Sheldon.....“	.....	5 28	3 14	H4 18	.....	.....	3 58	.....	.....	
223	Iroquois.....“	.....	.....	G 3 23	H4 27	.....	.....	4 10	.....	.....	
227	Donovan.....“	.....	.....	f 3 31	H4 36	.....	.....	4 24	.....	.....	
232	Beaverville.....“	.....	.....	f 3 41	H4 46	.....	.....	4 36	.....	.....	
238	St. Anne.....“	.....	.....	f 3 51	H4 56	.....	.....	4 51	.....	.....	
244	Aroma Park.....“	.....	.....	G 4 00	H5 06	.....	.....	5 02	.....	.....	
248	Kankakee.....Ar	3 20	6 16	4 20	5 15	6 10	8 05	5 20	.....	.....	
284	Harvey.....“	.....	.....	.....	H6 18	.....	.....	H6 17	.....	.....	
290	Kensington.....“	.....	.....	.....	H6 32	.....	.....	H6 25	.....	.....	
295	Grand Crossing“	.....	.....	.....	.....	.....	.....	.....	.....	.....	
296	63d Street.....“	4 36	7 41	5 47	6 45	7 30	9 21	6 38	.....	.....	
298	Hyde Park 53d St“	4 40	7 44	5 51	6 48	7 33	9 24	6 42	.....	.....	
299	43d Street.....“	4 43	7 47	5 55	6 51	7 36	9 27	6 46	.....	.....	
303	CHICAGO....Ar (Central Sta.— Mich. Ave. & Roosevelt Rd.)	4 55 PM	7 59 PM	6 10 AM	7 05 AM	7 50 AM	9 40 PM	7 00 PM	.....	.....	

"The Sycamore" carries baggage only between Indianapolis and Central Station, Chicago. No baggage handled to or from intermediate stations.

THE SYCAMORE

The description of each train by number and name is given at the top of the column which shows its running time. Each train leaves Cincinnati at the time mentioned on a line with Cincinnati and arrives at the other stations at the time given on a line with the names of the stations. No time, indicates that the train does not stop. The figures at the left of the names of the towns indicate the number of miles between the town and Cincinnati.

EXERCISE No. 36, SUBTRACTION OF DISTANCE AND TIME

The following problems in subtraction are based on the railroad time-table on the preceding page. These should be oral, unless your instructor requires them to be written.

1. Ascertain the distance between Morris and Kankakee.
2. Ascertain the distance between Spades and Chicago.
3. How long does it take Train No. 15 to go from Batesville to Lafayette?

NOTE: Time printed on the time-table in lightface type is between 12 midnight and 12 noon, and that printed in blackface type, between 12 noon and 12 midnight.

4. How long does it take Train No. 1 to go from Cincinnati to Sheldon?
5. Ascertain the distance between McCoy and St. Anne.
6. Ascertain the distance between Chicago and Adams.
7. How long does it take Train No. 27 to go from Guilford to Indianapolis?
8. The distance between Boston and New York on the New York, New Haven and Hartford Railroad is 232 miles. The distance between Boston and Springfield, Mass., which is between Boston and New York, is 98 miles. How far is it from Springfield to New York?
9. The distance between Chicago and Pittsburgh on the Pennsylvania railroad is 468 miles, and the distance from Fort Wayne to Chicago on the same road is 148 miles. How far is it from Fort Wayne to Pittsburgh?
10. The Overland Limited leaves Chicago at 8:10 p. m. Sunday, and arrives in San Francisco at 2:30 p. m. Wednesday. What is the exact time of this train in transit, the time being moved back one hour at North Platte and one hour at Ogden.
11. If a train leaves Portland, Oregon at 8:10 p. m. and arrives at Seattle, Washington at 1:30 p.m. the following day, what time is required for it to travel between these two cities, there being no change in time involved?
12. If Train No. 101, on the Southern Pacific, leaves New Orleans at 12:10 p. m. on Friday and arrives in El Paso at 9:20 p. m. on Saturday, what time is required to cover the distance? No change in time is involved.

BANKING

A bank is a business organized for the purpose of dealing in money and securities. One of the functions of a bank is to provide a safe place for money belonging to the bank and to others; and a convenient means of paying this money either to the owner or to others as directed by him. Money belonging to a bank and to those who have left it there for safe keeping is loaned to business men who wish to borrow and are willing to pay for the use of the money borrowed. The interest received for the use of the money loaned constitutes the principal income of a bank. Banks are operated under the supervision of the State or Federal laws; this supervision is for the protection of the depositors.

One who leaves money with a bank for safe keeping is known as a *depositor;* the money placed in a bank by a depositor is known as a *deposit.* A *deposit ticket* is a blank form provided by a bank for the convenience of its depositors when listing the cash or cash items to be deposited in the bank. A *check* is a blank provided by the bank for the convenience of its depositors when withdrawing the funds deposited with it.

The illustration at the right shows a deposit ticket with cash and cash items deposited. Cash includes paper money, gold, silver, and small change; cash items include bank checks. It is customary to arrange the currency in the order of the denominations, with the smaller denominations on top and to place small change in coin envelopes made to contain 50 pennies, 40 nickels, 50 dimes, and 40 quarters. Each check deposited is listed separately. The name of the city is written at the left if the check is payable on a bank in another city, and the name of the bank if it is payable in the same city. There are no universal rules applicable to the preparation of a deposit ticket, the details depending upon the regulations of the bank in which the deposit is made. You are advised to consult the receiving teller regarding the listing of deposits should you have occasion to deposit money in a bank. The receiving teller gives the depositor a receipt by writing the amount of each deposit in his pass book. This pass book is a small memorandum book provided by the bank.

DEPOSITED IN

THE PEOPLES BANK OF ERIE

By James Madison

ERIE, PA. Jan. 12 19

PLEASE LIST EACH CHECK SEPARATELY

	DOLLARS	CENTS
CURRENCY	100	
GOLD		
SILVER	56	52
CHECKS		
Chicago Ill	133	40
Denver Colo	93	60
Cincinnati O	66	22
Springfield Ill	110	20
Detroit Mich	127	86
First National	450	76
State National	17	62
	1156	18

The blank checks provided by a bank are usually bound in a book, each check attached to a stub. The book may contain one or more checks to the page. The illustration below shows a check book with two checks to a page. A stub is provided for each check in order that the depositor may have a permanent record of the checks he has issued. The bank account is kept on the stub by adding each deposit, and subtracting each check. The record on the check stubs should correspond with the record on the books of the bank when all the checks have been paid.

In the first check James Madison orders the Merchants National Bank to pay $53.75 to Loretto M. Willenborg. The record of this check on the stub indicates that Mr. Madison owed Miss Willenborg and that the check was issued in payment of the full amount he owed. The information on the stub also indicates that before writing the check Mr. Madison had $3,000 but after it was written, he had only $2,946.25.

In the second check Mr. Madison orders the bank to pay $200 to P. A. Mortenson. The record on the check stub shows that Mr. Madison bought some merchandise from Mr. Mortenson and this check is given in payment of it. The record on the check stub also shows that Mr. Madison had $2,746.25 in the bank after the check was written.

The depositor should state the information in the check in such a manner that it cannot be changed. If the amount of the check is changed through carelessness on the part of the depositor, the bank will not be responsible. There are many machines available for inserting the amount in a check as a means of insuring that the amount to be paid when the check is presented to the bank is that which the depositor had intended to be paid.

A *Bank Statement* is a form rendered monthly by the bank to each depositor. It contains a list of the deposits made by the depositor, the amount of each check issued by the depositor and paid by the bank, and the balance the depositor has in the bank. This balance may not be the same as that shown in the depositor's record on the check stubs, because all checks issued by the depositor may not have been presented to the bank for payment. Since the bank will return to the depositor with the statement all checks it has paid, the depositor can easily reconcile his balance with the bank's balance by checking the canceled checks with the stubs. The total of the checks not paid should be the difference between the balance shown by the bank and the balance shown by the depositor's record.

The illustration on page 51 shows the form of monthly statement rendered by the bank.

EXERCISE No. 37, TRANSACTIONS WITH A BANK

1. During the month of January, the Mills Restaurant Company performed the following transactions with the Merchants National Bank:

Jan.	2.	Deposited $1,476.52
	4.	Issued check No. 1 for $35
	6.	Issued check No. 2 for $47.96
	7.	Issued check No. 3 for $74.87
	9.	Issued check No. 4 for $13.55
	10.	Deposited $1,231.99
	10.	Issued check No. 5 for $206.48
	12.	Issued check No. 6 for $198.54
	13.	Issued check No. 7 for $54.25
	14.	Issued check No. 8 for $75.40
	16.	Issued check No. 9 for $146.14
	17.	Deposited $917.45
	19.	Issued check No. 10 for $255.80
	23.	Issued check No. 11 for $87.87
	24.	Issued check No. 12 for $205.75
	24.	Deposited $1,006.38
	25.	Issued check No. 13 for $19.20
	26.	Issued check No. 14 for $185.95

(Concluded on page 52)

Williamson, James K.,

IN ACCOUNT WITH

THE FIFTH-THIRD NATIONAL BANK 15 VOUCHERS RETURNED

OF CINCINNATI, OHIO.

REPORT PROMPTLY ANY CHANGE IN YOUR ADDRESS

PLEASE EXAMINE AT ONCE | IF NO ERROR IS REPORTED WITHIN TEN DAYS THE ACCOUNT WILL BE CONSIDERED CORRECT

DATE	CHECKS IN DETAIL			DATE	DEPOSITS
	BALANCE BROUGHT FORWARD			Sept. 1	$613.28
Sept. 1	100.00	20.00	6.25		
9	1.00	2.08		Sept. 10	150.00
15	6.00	21.76	9.13		
	1.82				
20	16.19	50.00		Sept. 20	50.00
				Sept. 25	150.00
30	12.50	16.50	19.00		
	101.28				
				BALANCE	$579.77

THIS BANK INVITES YOU
TO OPEN A SAVINGS ACCOUNT,
TO RENT A SAFE DEPOSIT BOX IN OUR SAFETY VAULTS.
TO PATRONIZE OUR BOND TRAVEL AND FOREIGN DEPARTMENTS

This statement was prepared by The Fifth-Third National Bank as a record of its transactions with James K. Williamson. The amounts shown on the left side are checks which have been paid by the bank. The entry on September 1 shows three checks paid, $100, $20, $6.25; September 9 two checks, $1, $2.08, etc.

The amounts on the right show the money on hand at the beginning of the month and that deposited during the month. The first entry on the right shows a balance of $613.28 on September 1. The second entry on the right is a deposit of $150 on September 10; the third, a deposit on September 20 of $50, and the fourth, a deposit on September 25 of $150.

The balance, $579.77, is ascertained by subtracting the total of the checks from the sum of the total deposits and the balance on hand at the beginning of the month. The depositor compares the canceled checks with his check stubs, indicating by a check mark on the stub those which have been returned. If one or more checks drawn on the bank have not been presented for payment, the balance on the depositor's check stub will be different from that shown by the bank, the difference being the total of the unpaid checks. Comparing the bank statement with the depositor's record is known as *reconciliation* of the bank account.

(*Exercise No. 37 [1]—Continued from page 50*)

27. Issued check No. 15 for $3.65
28. Issued check No. 16 for $125.60
31. Issued check No. 17 for $210.35
31. Deposited $1,158.64

You are required to show on tablet paper, (a) the balance in the bank after each deposit is added and each check written, (b) the reconciliation of the bank balance, $4,120.01, shown by the monthly bank statement, with checks Nos. 9, 15, and 16 unpaid.

2. The C. M. Yoder Laundry Machinery Company deposited the following cash and cash items in the Lincoln National Bank of Rochester, New York on May 6:

Currency, $122
Silver, $7.65
Check on Dallas, Texas, $275.55
Check on Fresno, California, $257.40
Check on Tacoma, Washington, $800
Check on Bangor, Maine, $375.44
Check on Atlanta, Georgia, $442.18
Check on Miami, Florida, $627.86
Check on New Orleans, Louisiana, $12.50
Check on Owensboro, Kentucky, $562.75

The bank allows credit for the amount of this deposit, less $2.68, the charges for collecting the out of town checks. Prepare a deposit ticket similar to the illustration, using tablet paper. Show (a) the amount of the cash and cash items, and (b) the amount of the credit after deducting the collection charges; this deduction is indicated by writing "less" on a line with the collection charge, and writing the collection charge immediately under the total and subtracting.

3. July 1, H. A. Porter received a statement from the City National Bank showing his balance to be $1,456.85. This is $200 more than the balance shown on the check stubs, because check No. 71, written on June 30 has not been paid by the bank. During the month of July he performed the following transactions with the bank:

July 3. Issued check No. 72 for $50
5. Issued check No. 73 for $17.85

(*Concluded on page 53*)

(*Exercise No. 37 [3]—Continued from page 52*)

7. Issued check No. 74 for $846.55
9. Deposited $256.40
11. Issued check No. 75 for $208.62
15. Issued check No. 76 for $13.15
17. Deposited $144.67
18. Issued check No. 77 for $36.55
21. Issued check No. 78 for $175
25. Deposited $150
28. Deposited $18.55
28. Issued check No. 79 for $55.60
30. Issued check No. 80 for $98.47

August 1, he received from the bank a statement showing a balance of $403.15 with all checks issued returned except No. 80. On tablet paper show the check stub calculations, then verify the bank balance with the balance shown on the check stubs. Report the amount of the discrepancy to the instructor for explanation.

4. L. Harrison deposited the following cash and cash items in the Cleveland National Bank, Cleveland, Ohio on August 6:

Currency, $250
Silver, $37.58
Check on First Nat'l Bank, $55.40
Check on Cincinnati, Ohio, $128.65
Check on New York City, $827.65
Check on Chicago, Illinois, $247.85
Check on Milwaukee, Wisconsin, $118.72

The bank credits his account with the full amount of his deposit. Prepare a deposit ticket showing the amount with which Mr. Harrison's account was credited.

5. J. L. Miller deposited $873 with the Farmers National Bank on October 1. During October, November and December he performed the following transactions:

Oct. 5. Issued check for $46.35
5. Issued check for $75.25
11. Issued check for $104.56
15. Depcsited $645
18. Issued check for $45.95
25. Issued check for $203.33

(*Concluded on page 54*)

(*Exercise No. 37* [5]—*Continued from page 52*)

Nov. 1. Deposited $402.25
3. Issued check for $55.23
7. Issued check for $72.33
12. Issued check for $25.50
15. Issued check for $64.45
15. Issued check for $25.48
20. Deposited $105.45
25. Issued check for $69.93

Dec. 1. Deposited $809.96
3. Issued check for $55.25
3. Issued check for $25.42
8. Issued check for $14.15
15. Deposited $785.50
18. Issued check for $86.07
28. Issued check for $45.55

January 2, he received a statement from the bank showing a balance of $2,692.84 with checks issued on November 7 and December 8 still unpaid. Verify this by showing on tablet paper the same information Mr. Miller would have on his check stubs, assuming that the two checks are unpaid.

EXERCISE No. 38, ORAL SUBTRACTION

The following advertisement setting forth bargain prices appeared in a daily newspaper. You are to state the saving to the purchaser on each article in accordance with the prices in the advertisement.

50c Jonteel Cold Cream 39c
25c Cuticura Soap 18c
25c Resinol Soap 19c
25c Woodbury Soap 17c
$1.25 Lilac Vegetal 86c
75c Java Rice Powder 39c
50c Hinds Cream 35c
50c Mennen's Cream 34c
50c Pepsodent Tooth Paste 36c
50c Ipana Tooth Paste 37c
35c Ponds Vanishing Cream 23c
75c Stacomb 59c
50c Jonteel Van. Cream 39c
$1.00 Listerine 73c
$1.00 Rem for coughs 69c
75c Olive Oil 49c

CASH ACCOUNT

A record of cash received and cash paid made in the form illustrated at the top of page 55 is known as a *Cash account.* The account form may also be used for recording other facts when it is desired to indicate addition and subtraction by position.

CASH

Feb.	1			1000		Feb.	1			725	50
	2			25	50		2			50	
	5			232	65		9			42	50
	10			118	45		10			137	50
	12			87	45		16			42	50
	17			112	65		18			187	50
	20			98	40		23			42	50
	24			109	20		25			13	50
	26			98	40		26			41	75
	28			88	90		*28*	*Balance*		*688*	*35*
				1971	60					1971	60
Mar.	1	Balance		688	35						

The illustration shows a record of the following transactions:

February 1, C. H. Moore invested $1,000 in the Grocery business.

Cash received is recorded on the left side under the date received.

February 1, paid $725.50 for stock of merchandise.

Cash paid is recorded on the right side under the date it was paid.

February 2, received $25.50 for merchandise sold.

Cash received is recorded on the left side under the date received with the figures arranged for addition.

February 2, paid $50 for rent.

Cash paid is recorded on the right side under the date paid with the figures arranged for addition.

Feb. 5. Received $232.65 for merchandise sold
9. Paid clerks $42.50
10. Received $118.45 for merchandise sold
10. Paid $137.50 for merchandise purchased
12. Received $87.45 for merchandise purchased
16. Paid $42.50 in cash to clerks
17. Received $112.65 for merchandise sold
18. Paid $187.50 for merchandise purchased
20. Received $98.40 for merchandise sold
23. Paid clerks $42.50
24. Received for merchandise sold $109.20
25. Paid $13.50 for merchandise purchased
26. Received $98.40 for merchandise sold
26. Paid $41.75 for merchandise purchased
28. Received $88.90 for merchandise sold

The bookkeeping term used to describe the left side of an account is *debit*, the right side, *credit*, and the difference between the two sides, *balance*. The cash on hand should be the same as the balance which is the difference between the total debits and total credits. Ascertaining this fact is known as *proving cash*.

EXERCISE No. 39, CASH ACCOUNT

The following problems provide written practice in recording transactions in account form. You are to enter the amounts on the debit or credit side of the account, as in the illustration of the Cash account, or as instructed in the exercise.

1. D. A. Wells, a retail fruit merchant, performed the following cash transactions during the first week in June:

June 1. Balance on hand, $126.80; paid rent, $60; cash sales for the day as per cash register, $75.25.
2. Paid for fruit and express, $37.85; received for cash sales as per cash register, $49.19.
3. Paid clerk $10; received for cash sales as per cash register, $39.14.
4. Paid occupational tax, $2.50; paid for fruit purchased, $22.85; received for cash sales as per cash register, $22.19.
5. Paid telephone bill, $2.75; paid for fruit purchased, $39.16; received for cash sales as per cash register, $41.77.
6. Paid gas and electric bill, $1.57; paid for fruit purchased, $29.65; paid balance due clerk, $7.50; cash sales as per cash register, $52.65.

Record these transactions in account form as illustrated on page 55. The balance on hand, each receipt, and the date received is entered on the left; each payment, and the date paid is entered on the right. The balance of cash on hand should be the difference between the total debits and the total credits.

2. A. L. Graham completed the following cash transactions during the first fifteen days in March:

Mar. 1. Invested $3,500 in cash
2. Paid for team and wagon, $300
3. Paid for office and store fixtures, $650

(*Concluded on page 57*)

(*Exercise No. 39 [2]—Continued from page 56*)

5. Received for cash sales, $304.87; paid cash for merchandise, $1,500
6. Received from Caleb Brothers, $50; paid sundry expenses, $127
7. Paid $150 for safe; received from O. H. Arnold, $64
8. Cash purchases, $330.75; received for cash sales, $204.18
9. Received from H. F. Ritter, $15; cash purchase, $28.65
10. Cash sales, $264.85; received from O. B. Donaldson, $50
12. Cash sales, $15.79; paid Belknap Hardware Co., $629.87
14. Paid sundry expenses, $72.50; paid C. R. Crawford, $75
15. Received from H. F. Ritter, $20; borrowed from the bank, $1,000

What is his cash balance on March 16?

3. Alvin Young performed the following transactions with his grocer during the month of March. The grocer entered the date and amount of each sale on the debit side of the account with Mr. Young; and the date and amount of cash received from Mr. Young on the credit side, also the value, date, and amount of all goods returned for credit. The difference between the sales on the debit side, and the credits for cash plus the credits for goods returned is the amount due the grocer from Mr. Young.

Mar. 1. Purchased groceries, $2.65
5. Purchased groceries, $9.87
7. Purchased groceries, $11.42
9. Paid $10 in part payment for previous purchases
12. Purchased groceries, $7.16
13. Purchased groceries, 88c
14. Purchased groceries, $9.65
16. Paid $20 in part payment for previous purchases
18. Purchased groceries, $4.19
21. Purchased groceries, $7.15

(*Concluded on page 58*)

(*Exercise No. 39 [3]—Continued from page 57*)

24. Returned 3 cans tomatoes at 35c each for credit
25. Purchased groceries, $1.65
28. Purchased groceries, $15.44

How much does Mr. Young owe the grocer April 1?

You will record the above transactions in account form under the name Alvin Young. The balance due April 1, will be the difference between the total of the debit side and the total of the credit side.

One who buys from a merchant on account, that is, who promises to pay on the first of each month, may know the amount he owes the merchant if he keeps a record of the sales tickets or sales invoices which the merchant renders with each sale of merchandise. It is quite evident that the customer is interested in knowing that the facts set forth in the statement are correct. He should retain these invoices so that he may check the amount of each with the amounts in the statement because there is always a possibility of the merchant's charging one customer with merchandise purchased by another.

4. The monthly sales and returned sales of the Fair Store during the year beginning with January were as follows:

Jan. 31. Sales, $11,642.91; returned sales, $418.23
Feb. 28. Sales, $ 9,487.25; returned sales, $325.87
Mar. 31. Sales, $13,587.44; returned sales, $225.45
Apr. 30. Sales, $13,795.53; returned sales, $427.45
May 31. Sales, $14,893.38; returned sales, $362.25
June 30. Sales, $12,374.85; returned sales, $259.95
July 31. Sales, $12,375.82; returned sales, $343.73
Aug. 31. Sales, $11,385.82; returned sales, $389.92
Sept. 30. Sales, $ 9,323.44; returned sales, $258.45
Oct. 31. Sales, $10,682.25; returned sales, $268.43
Nov. 30. Sales, $10,928.44; returned sales, $284.42
Dec. 31. Sales, $11,483.35; returned sales, $325.55

Record the above transactions in account form under the title "Sales". Enter the date and total sales for each month on the credit side, and the date and total returns on the debit side. The balance, which is the difference between the two totals, will be the net sales made during the year. The Fair Store keeps a record of its sales, because this information is needed in preparing its Income Tax statement.

5. Robert Browning, a clerk, receives a salary of $300 per month. He wishes to keep a record of his income from his salary,

and his living expenses so that he may know the excess of income over expenses. During the quarter ending March 31, his income and expenses were as follows:

Jan. 1. Received December salary, $300; paid rent, $52
2. Paid light bill, $2.80; telephone, $2.25
15. Paid $12.50 for clothing
31. Paid $38.65 for groceries and meat
Feb. 1. Received January salary, $300; paid rent, $52; paid insurance, $113.85
2. Paid for light, $2.45; telephone, $2.25
28. Paid $32.45 for groceries and meat
Mar. 1. Received February salary, $300; paid for clothing, $35.80
2. Paid for light, $1.65; telephone, $2.25
15. Paid insurance on household furnishings, $18.50
18. Paid for house furnishings, $55.75
31. Paid $35.60 for groceries and meat

Record the above transactions in account form under the title "Income and Expenses". Income is recorded on the credit side of the account and expenses on the debit side. The difference between the total income and total expenses is Mr. Browning's savings during the three months. On the left side under date of April 1, write "Savings" and the amount and rule the account in the same form as the Cash account.

6. R. H. Norman, a farmer, wishes to keep a record of the sales of chickens and eggs and his expenses in connection with the upkeep of the poultry. During the first six months of the year, he completed the following transactions.

Jan. 2. Purchased poultry $126.50
7. Sales of chickens and eggs, $12.65
12. Paid for feed $3.50
15. Sales of chickens and eggs, $18.75
18. Paid for feed $4.50
24. Sales of chickens and eggs, $15.50
27. Paid for feed $2.25
Feb. 6. Sales of chickens and eggs, $16.45
9. Purchased poultry $45.50
10. Paid for feed $1.75

(Concluded on page 60)

(*Exercise No. 39 [6]—Continued from page 59*)

18. Sales of chickens and eggs, $21.45
21. Paid for feed $3
25. Sales of chickens and eggs, $19.65
28. Paid for feed $1.25

Mar. 8. Sales of chickens and eggs, $20.55
10. Paid for feed $2.55
19. Sales of chickens and eggs, $22.75
21. Paid for feed $3.25
27. Sales of chickens and eggs, $21.50
29. Paid for feed $1.75

April 2. Sales of chickens and eggs, $22.55
3. Paid for feed $3
15. Sales of chickens and eggs, $17.50
18. Paid for feed $3.25
27. Sales of chickens and eggs, $18.95
29. Paid for feed $2.25

May 8. Sales of chickens and eggs, $21.75
9. Paid for feed $2.50
18. Sales of chickens and eggs, $23.50
19. Paid for feed $1.50
25. Sales of chickens and eggs, $12.45
27. Paid for feed $1.75

June 6. Sales of chickens and eggs, $15.50
19. Sales of chickens and eggs, $14.75
20. Paid for feed $2.15
26. Sales of chickens and eggs, $12.95
27. Paid for feed $1.25
30. Sold all chickens and eggs on hand for $129.50

You are to record in account form under the title "Poultry Income and Expense" the transactions outlined above. The cost of the chickens and feed should be recorded on the debit side, and the amounts received from sales recorded on the credit side. The balance will be the net income; that is, the cash received in excess of the cash paid. When you have ascertained the profit, enter this on the debit side under date of June 30 and rule the account.

CHAPTER V

MULTIPLICATION

The purpose of this chapter is to provide practice in multiplication, short-cut methods for applying the process, and proof of the product. The information is given under the assumption that you understand the mathematical principles involved in the multiplication process.

Multiplication is a short method of addition. The *product* is the result obtained by multiplication, and is the same as the sum, if the process were by addition.

The *multiplicand* and the *multiplier* are the factors of the product. In other words, the multiplicand is the number to be added, and the multiplier the number of times it is to be added. If the number to be added refers to some specific article, it is quite evident that the product obtained by adding the desired number of times would refer to the same article.

Illustration. A farmer sells five bushels of wheat at $1.60 per bushel. Five is the multiplier, and $1.60 the multiplicand. The sum of $1.60 repeated five times in a column is $8.00. If this problem had been 160 pounds of rice at 5c per pound, the multiplier would have been 160 and the multiplicand would have been five. The sum of five repeated 160 times in a column and added is $8.00. This illustration will show you that it is necessary to consider the nature of the problem and the information desired, rather than to try to memorize any definite rules regarding the multiplier and multiplicand.

The *process of multiplication* when applied to business problems is usually indicated by writing the word "at" or the symbol "@" between the multiplier and the multiplicand. Sometimes in invoices where a statement of the facts indicates multiplication, the word "at" and the symbol may be omitted.

Illustration. "10 lbs. of coffee at 35c" is equal to 35 multiplied by 10; the product is $3.50 because 35c is added ten times. Where the price applies to a specific quantity the word "at" is omitted; "10 lbs. salt, 75c", indicates that the selling price of the entire quantity is 75c.

Accuracy in multiplication is of great importance especially in the solution of those business problems which relate to the

amount of a sale. If the multiplication is incorrect, either the buyer or the seller loses if the error is not discovered.

Illustration. You purchased from the butcher 9 lbs. of meat at 29c per lb., and gave him a five-dollar bill in payment. He made an error of 10c in his calculations, recording the amount as $2.51 instead of $2.61 and gave you change accordingly. At the end of the day he proved his record of cash by counting the cash in the cash register. This error of 10c would not be detected by his proof, because the amount recorded and the amount of cash received, which serve as a proof of his cash record, were the same.

EXERCISE No. 40, THE MULTIPLICATION TABLE

The purpose of the multiplication table given below is to provide oral practice in the multiplication of numbers up to and including 15 multiplied by 15.

1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*
2	4	6	8	10	12	14	16	18	20	22	24	26	28	30
3	6	9	12	15	18	21	24	27	30	33	36	39	42	45
4	8	12	16	20	24	28	32	36	40	44	48	52	56	60
5	10	15	20	25	30	35	40	45	50	55	60	65	70	75
6	12	18	24	30	36	42	48	54	60	66	72	78	84	90
7	14	21	28	35	42	49	56	63	70	77	84	91	98	105
8	16	24	32	40	48	56	64	72	80	88	96	104	112	120
9	18	27	36	45	54	63	72	81	90	99	108	117	126	135
10	20	30	40	50	60	70	80	90	100	110	120	130	140	150
11	22	33	44	55	66	77	88	99	110	121	132	143	154	165
12	24	36	48	60	72	84	96	108	120	132	144	156	168	180
13	26	39	52	65	78	91	104	117	130	143	156	169	182	195
14	28	42	56	70	84	98	112	126	140	154	168	182	196	210
15	30	45	60	75	90	105	120	135	150	165	180	195	210	225

EXERCISE No. 41, MULTIPLICATION

The purpose of the following problems is to provide further oral drill in multiplication.

1	2	3	4	5	6
a. 15× 9	*a.* 14×13	*a.* 15×12	*a.* 15×13	*a.* 12×11	*a.* 15× 8
b. 13×11	*b.* 7×15	*b.* 14× 8	*b.* 12×11	*b.* 13×12	*b.* 7×11
c. 14× 7	*c.* 12×13	*c.* 13×11	*c.* 13×14	*c.* 14×13	*c.* 13×15
d. 11×15	*d.* 14×12	*d.* 9×14	*d.* 14×12	*d.* 13×13	*d.* 14× 9
e. 15× 7	*e.* 12×15	*e.* 14×11	*e.* 13× 7	*e.* 11×15	*e.* 9×15
f. 9×12	*f.* 13×11	*f.* 13× 9	*f.* 12×11	*f.* 13×11	*f.* 12×11

EXERCISE No. 42, PROCESS AND PROOF OF MULTIPLICATION

Multiplication is a short-cut process of addition, hence the product can be proved in the same manner as the sum in addition, that is, by reverse process and by check figures. The illustration below shows the process of multiplication and proof by reverse multiplication applied to the problem 671 multiplied by 196.

671		196
196	You will observe that the multiplier and multiplicand are reversed in order to prove by reverse multiplication. It is better when proving by this method to make the calculations on a separate sheet of paper, then compare the results.	671
4026		196
6039		1372
671		1176
131516		131516

The following problems provide written practice in multiplication. You are to show on tablet paper the process of multiplication with the multiplicand above the multiplier and the process by the reverse method in which the multiplicand is below the multiplier.

1	2	3	4
a. 2,792×347	*a.* 6,453×999	*a.* 3,765×2,839	*a.* 7,837×4,723
b. 3,806×342	*b.* 4,700×387	*b.* 4,274×3,746	*b.* 1,238×3,746
c. 4,785×617	*c.* 8,876×427	*c.* 3,989×1,894	*c.* 8,132×7,325
d. 8,293×723	*d.* 9,423×471	*d.* 4,563×8,139	*d.* 2,736×4,635

EXERCISE No. 43, PROOF OF MULTIPLICATION BY A CHECK FIGURE

The product in multiplication can be proved by a check figure the same as the sum in addition. The illustration below shows the process of multiplication and the proof by the check figure 9 applied to the problem 671 multiplied by 196.

671 = 6+7+1 = 14 = 5
196 = 1+9+6 = 16 = 7

4026
6039
671

35 = 8

131516 = 1+3+1+5+1+6 = 17 = 8

Eliminating the nines from the multiplicand gives a remainder of 5 and from the multiplier a remainder of 7; 5 multiplied by 7 equals 35; eliminating the nines from 35 gives the proof figure 8; eliminating the nines from the product gives the proof figure 8 which indicates the results are correct because the two proof figures are the same.

The following problems provide written practice in multiplication and proof by the check figures 9 and 11. You will show on tablet paper the multiplication process in each problem and prove problems 1 and 3 with the check figure 9, and problems 2 and 4 with the check figure 11. Arrange your work the same as in the illustration.

1	2	3	4
a. 4,875×329	*a.* 2,938×643	*a.* 5,907×335	*a.* 1,475×317
b. 9,802×678	*b.* 7,214×521	*b.* 6,218×865	*b.* 3,918×594
c. 7,743×237	*c.* 8,347×423	*c.* 4,253×789	*c.* 6,714×845
d. 6,584×567	*d.* 1,987×925	*d.* 9,216×415	*d.* 8,231×953

EXERCISE No. 44, ADDITION, SUBTRACTION, AND MULTIPLICATION

The following problems provide oral practice in adding, subtracting, and multiplying. You will complete the operations in the order given as indicated by the signs.

The mental process of completing problem 1a would be "3 times 4 equals 12, plus 8 equals 20, minus 10 equals 10, times 4 equals 40, times 2 equals 80," or expressed more briefly "12, 20, 10, 40, 80".

1	2
a. 3×4+8−10×4×2=	*a.* 6×6−6×3+8−48=
b. 6×7−2×3+8−60=	*b.* 8+7×3−5+9×4=
c. 9+6−5×3+7+3=	*c.* 4×5−9+9×3−40=
d. 9−3×8−8+2×4=	*d.* 3×8−4×3+6−36=

3	4
a. 5×4−4×3+8−16=	*a.* 4−2×8−6×4×3=
b. 9+1×5−8+2+40=	*b.* 8+2×5+8−3×2=
c. 8×5−8−2×3−25=	*c.* 4×5+8×2+9−35=
d. 8−2×5−8+2×4=	*d.* 9−3×5+6−3×3=

5. 6×5−20×4+8−18+2−16+4−5×3+5×2−50−25=

6. 9+1×4−5+9×1−4+20−40×2+8+7−5×2−60+5=

SHORT-CUTS IN MULTIPLICATION

There are no short-cuts in the process of multiplication which are applicable in all cases, but, there are conditions under which short-cut methods may be used to advantage. Some of these are illustrated in the following problems. Give careful attention to each process so that you may become more proficient in multiplication.

EXERCISE No. 45, MULTIPLYING BY A NUMBER ENDING IN ONE

When the digit in the units column of the multiplier is one, time can be saved by proceeding as illustrated below.

$735 \times 31 = 735$	$\$7.35 \times 31 = 735$	$\$4.67 \times 111 = 467$
2205	2205	5137
22785	$227.85	$518.37

You will observe that the product of the multiplication by the digit in the tens column of the multiplier is written underneath the multiplicand, and that when dollars and cents are involved, the cents are indicated in the product.

The following problems provide written practice in multiplying when the multiplier ends in one. Arrange your work as in the illustration.

1	2	3	4
a. 845×21	*a.* $\$38.64 \times 121$	*a.* 745×161	*a.* $485 \times 51c$
b. 607×91	*b.* $\$45.25 \times 151$	*b.* 869×181	*b.* $839 \times 21c$
c. 184×31	*c.* $\$93.34 \times 131$	*c.* 723×131	*c.* $784 \times 41c$
d. 726×51	*d.* $\$67.45 \times 171$	*d.* 398×141	*d.* $287 \times 31c$
e. 815×81	*e.* $\$92.89 \times 141$	*e.* 757×121	*e.* $948 \times 81c$
f. 526×41	*f.* $\$78.26 \times 161$	*f.* 485×151	*f.* $746 \times 71c$

EXERCISE No. 46, SPECIAL

When the sum of the digits in the units column of both multiplier and multiplicand is ten, and the digits in the tens column are alike, the process below may be applied with a saving of time. In this problem it is desired to multiply 32 by 38.

32
38
1216

Write the product of the unit digits, $8 \times 2 = 16$.
Add 1 to the digit in the tens column of the multiplier, multiply by the digit in the tens column of the multiplicand, and bring down the product, $3 + 1 \times 3 = 12$.

The following problems provide written practice in the application of the short-cut method described above.

1	2	3	4
a. $25 \times 25 =$	*a.* $75 \times 75 =$	*a.* $52 \times 58 =$	*a.* $73 \times 77 =$
b. $27 \times 23 =$	*b.* $45 \times 45 =$	*b.* $59 \times 51 =$*	*b.* $99 \times 91 =$
c. $82 \times 88 =$	*c.* $33 \times 37 =$	*c.* $65 \times 65 =$	*c.* $36 \times 34 =$

*NOTE: When the product of the digits in the units column is less than 10, place a cipher in the tens place of the product as illustrated at the right.

59
51
3009

EXERCISE No. 47, SPECIAL

When the units digits in the multiplier and multiplicand are the same and the sum of the tens digits is ten, the solution below may be used. This shows the multiplication of 76 by 36.

$$\begin{array}{r} 76 \\ 36 \\ \hline 2736 \end{array}$$

The illustration at the left shows the solution of 76×36. The product of the units digits, 36, is written below the line and the units digit is added to the product of the tens digits and this amount written at the left of the product of the units digits. $6 \times 6 = 36$; $3 \times 7 = 21$; $21 + 6 = 27$; 2,736 = the product.

The following problems provide oral practice in applying the process of multiplication explained in the above illustration.

1	2	3	4
a. $28 \times 88 =$	*a*. $61 \times 41 =$	*a*. $34 \times 74 =$	*a*. $54 \times 54 =$
b. $45 \times 65 =$	*b*. $24 \times 84 =$	*b*. $36 \times 76 =$	*b*. $48 \times 68 =$
c. $73 \times 33 =$	*c*. $77 \times 37 =$	*c*. $62 \times 42 =$	*c*. $23 \times 83 =$
d. $29 \times 89 =$	*d*. $32 \times 72 =$	*d*. $16 \times 96 =$	*d*. $71 \times 31 =$

EXERCISE No. 48, CROSS MULTIPLICATION

Cross multiplication may be applied to an advantage when neither of the combinations illustrated in the two preceding exercises are applicable. The illustration below shows the process of multiplying 37 by 42, and the information at the right explains the process.

$$\begin{array}{r} 37 \\ 42 \\ \hline 1554 \end{array}$$

$2 \times 7 = 14$, place the 4 and carry the 1.
$4 \times 7 = 28$ and $2 \times 3 = 6$.
$28 + 6 + 1 = 35$, place the 5 and carry the 3.
$4 \times 3 = 12 + 3 = 15$.

The following problems provide written practice in applying cross multiplication. Show the information at the right of the illustration in connection with each problem in the first column; and the multiplicand, multiplier, and product only for those in the other columns.

1	2	3	4
a. $24 \times 37 =$	*a*. $81 \times 24 =$	*a*. $32 \times 17 =$	*a*. $63 \times 24 =$
b. $55 \times 28 =$	*b*. $56 \times 45 =$	*b*. $72 \times 19 =$	*b*. $82 \times 45 =$
c. $73 \times 24 =$	*c*. $59 \times 28 =$	*c*. $35 \times 58 =$	*c*. $21 \times 36 =$
d. $59 \times 73 =$	*d*. $29 \times 16 =$	*d*. $24 \times 31 =$	*d*. $37 \times 42 =$

EXERCISE No. 49, NUMBERS ENDING WITH FIVE

When the units digits in both the multiplicand and multiplier are five, and the sum of the tens digits is even, the product will end in 25, and the number at the left of this will be the product of the tens digits plus one half of their sum. The illustration below shows this process applied to the multiplication of 85 by 45.

85
45
3825

The mental process of multiplying 85 by 45 is 4 times 8 is 32, plus 6 ($\frac{1}{2}$ of [4 plus 8]) is 38. No mental process is necessary in obtaining the two numbers at the right in the product, because they are always 25 when the sum of the tens digits is even.

When the units digits in both the multiplicand and multiplier are five, and the sum of the tens digits is odd, the product will end in 75, and the number at the left of this will be the product of the tens digits, plus one half of the sum of the tens digits with the fraction discarded.

65
35
2275

The mental process of multiplying 65 by 35 is 3 times 6 is 18, plus 4 ($\frac{1}{2}$ of [3 plus 6] with the fraction discarded) is 22. There is no mental process in obtaining the two numbers at the right in the product, because they are always 75 when the sum of the tens digits is odd.

This method is satisfactory when there are only two or not more than three digits in either the multiplier or multiplicand. When dollars and cents are involved, the two right-hand digits in the product, will be cents, and the digits at the left of the cents will be dollars.

The following problems provide oral practice in applying these short-cut methods of multiplication. Keep in mind the fact that the product of the units digits is known to be either 25 or 75, hence you must concentrate on arriving at the product of the tens digits, then call the entire product beginning with the product of the tens digits.

1	2	3
a. 95×35	*a.* 145×75	*a.* 155×35c
b. 65×45	*b.* $1.25×35	*b.* 125×25c
c. 55×35	*c.* $1.35×25	*c.* 135×45
d. 75×65	*d.* $1.55×55	*d.* 135×15c
e. 135×25	*e.* $1.45×45	*e.* 25×85
f. 142×65	*f.* 145×25c	*f.* 165×25

EXERCISE No. 50, TEN OR A MULTIPLE OF TEN

When the multiplier is ten or a power of ten, the product is ascertained by adding as many ciphers to the multiplicand as there are ciphers in the multiplier. If dollars and cents are involved, the last two figures in the product will be cents and the figures at the left of the cents will be dollars. The following problems provide oral practice in multiplying by ten or a multiple of ten.

1	2	3
a. \$67,719×10	*a.* \$37.94×10	*a.* \$132.40×1,000
b. \$58,836×10	*b.* \$57.78×10	*b.* \$105.55×1,000
c. \$47,537×10	*c.* \$67.25×100	*c.* \$156.25×1,000
d. \$58,375×10	*d.* \$375.89×100	*d.* \$178.27×1,000
e. \$45.35×10	*e.* \$928.38×100	*e.* 3,725×100
f. \$78.87×10	*f.* \$747.38×100	*f.* 8,740×1.000

EXERCISE No. 51, NINETY-NINE OR ONE HUNDRED ONE

When either the multiplicand or multiplier is 99 or 101, the product may be ascertained in the first case by multiplying by 100 and subtracting the amount of the multiplicand, or in the second case by multiplying by 100 and adding the amount of the multiplicand. $786 \times 99 = 77{,}814$; $786 \times 101 = 79{,}386$.

$786 \times 99 = 78{,}600 - 786 = 77{,}814$; $786 \times 101 = 78{,}600 + 786 = 79{,}386$.

The same process will apply when the multiplier is 999 or 1,001, but in business problems, the 99 and 101 will be used more frequently. This process might be extended to include 102, 103, 104, etc., but it is better to follow the usual process, because the application of the short-cut method would be more difficult.

When multiplying by 99 or 101 where dollars and cents are involved, the two right-hand figures in the product will be cents, and the figures at the left of the cents will be dollars. The following problems provide written practice in applying this procedure.

1	2	3
a. 48,572×99c	*a.* 8,275×101	*a.* 3,465×\$1.01
b. 67,392×99c	*b.* 4,738×101	*b.* 7,836×\$1.01
c. 78,473×99c	*c.* 5,647×101	*c.* 6,927×\$1.01
d. 92,837×99c	*d.* 4,738×101	*d.* 8,947×\$1.01
e. 47,384×99c	*e.* 2,938×101	*e.* 7,725×\$1.01
f. 92,837×99c	*f.* 9,384×101	*f.* 5,427×\$1.01

EXERCISE No. 52, APPLICATION OF SHORT-CUTS

The following problems provide written practice in applying all of the short-cut methods discussed in the preceding exercises. You are required to write the product of each item, and the total of all items in each problem. Indicate immediately after the total, the exercise number in which the short-cut method used was explained. Prove the addition in each problem by the elimination of nines in the first two, by the elimination of elevens in the second two, and by reverse multiplication in the last one.

1. Find the cost of the following:
89 lbs. bacon at 29c per pound
62 pounds of butter at 42c per pound
37 pounds of prunes at 16c per pound
75 pounds of lard at 15c per pound
145 pounds of tea at 99c per pound

2. Find the cost of:
165 bushels of corn at 85c per bushel
85 bushels of wheat at $1.25 per bushel
122 bushels of wheat at $1.28 per bushel
55 bushels of oats at 55c per bushel

3. Find the cost of:
25 dozen pocket knives at $3.75
36 Gillette razors at 96c each
48 Eveready Flashlights at 67c
22 children's skates at 88c
86 vacuum bottles at 84c

4. Find the cost of:
35 boys' blouses at $1.95
36 men's socks at 76c
45 men's initialed handkerchiefs at 35c
25 men's socks at 85c
345 children's mufflers at $1.01

5. Find the cost of:
75 Orchard games at 95c
32 boxes of "Tru-Life Paper Dolls" at 38c
31 "Knock-Out Prize Fighters" at 39c
15 scooters at $4.75
55 Ham and Sam at $1.45

BILLING

When merchandise is sold, the buyer receives in addition to the merchandise a list of the merchandise he has purchased. This list is known as an *invoice;* in the retail business it is sometimes referred to as a *sales ticket.* The buyer regards the list of goods which he has bought as a purchase invoice, and the seller regards it as a sales invoice. There is always a buyer and a seller in connection with every sale of merchandise.

There is no standard form of blank to be used for the preparation of invoices. Every business concern provides its own form to meet the desire of the owner, and the conditions under which the business is operating. The illustration below shows one form of an invoice. In addition to the list of merchandise which changed hands as evidenced by the invoice, it contains the date, the name and address of the buyer, the name and address of the seller, the terms, and the method of delivery. The invoice may also contain any other information which the seller may wish it to show. This is explained more fully in connection with the study of bookkeeping where this additional information has a bearing on the bookkeeping records.

H. L. RICHESON & CO.
CASH WHOLESALE GROCERS
521 EAST FIRST STREET

SUGAR H L R C KINGS

DAYTON, OHIO October 15, 192

SOLD TO W. R. Swanson Grocery Co. DATE
3612 Creighton Ave., Dayton, Ohio.

TERMS Net 10 days
OUR ORDER NO. S 11161 YOUR ORDER NO. 112 DELIVERED Via truck

600 lbs.	Granulated Sugar (6 scks. 100 lbs. each)	cwt. 5.75	34	50
300 lbs.	Domino Sugar (2 pound cartons)	cwt. 6.25	18	75
120 lbs.	Confectionery Sugar (1 pound cartons)	cwt. 7.50	9	00
6 doz.	cans Peaches (3 cases)	doz. 2.50	15	00
10 doz.	cans Corn (5 cases)	doz. 2.00	20	00
			97	25

Accuracy is essential in ascertaining the value of merchandise sold, because an error in the invoice means a loss to either the buyer or seller. As explained in previous discussions, the recording of business transactions in accordance with the standard bookkeeping

process will not detect errors in the invoice. The usual process of multiplication is applied when it is necessary to ascertain the value of the merchandise sold. Ascertaining the value of merchandise sold as listed on the invoice is known as *making extensions*. Short-cut methods in multiplication may be applied to advantage when making these extensions, thus insuring speed and accuracy.

EXERCISE No. 53, BILLING

The following problems provide written practice in billing in six different lines of merchandise. The information is not given in the form of an invoice, but this is not necessary in order to make the extensions. Write the amount of each extension in the order in which it is given in the problem, and ascertain the total of all items sold. Prove the correctness of the multiplication of each extension, and the addition of the total.

1. Wholesale dry goods:
   15 bolts of percale at $4.85*
   18 yards of velvet at $3.75
   8 bolts of domestic cotton at $4.40
   39 bolts of binding tape at 31c
   25 bolts of sheeting at $15
   80 yards of flannel at $1.98

2. Wholesale groceries:
   12 dozen bars of Palmolive soap at 53c
   15 dozen cans of tomatoes at $1.35
   6 dozen cans of California peaches at $2.42
   5 dozen cans of asparagus at $3.05
   9 dozen cans of cherries at $2.25
   25 dozen Delmonte Alaska salmon at $2.05

3. Wholesale sugar:
   1263 pounds (3 barrels) granulated sugar at 7c
   656 pounds (2 barrels) brown sugar at 6c
   400 pounds (16 sacks) granulated sugar at 8c
   225 boxes Domino sugar at 21c
   82 boxes powdered sugar at 88c
   35 boxes of powdered sugar at 55c

*NOTE: The price given applies to the quantity mentioned. Thus, if the quantity is given in dozens, the price stated will be per dozen and not per article.

4. Wholesale provisions:

855 pounds of leaf lard at 19c
125 pounds of breakfast bacon at 35c
416 pounds of ham at 27c
125 pounds of premium butter at 45c
227 pounds of chicken at 43c
516 pounds of bacon sides at 16c

5. Mechanical toys:

25 Racing cars at 25c
35 Crazy cars at 79c
42 Automobiles at 62c
35 "Spark Plugs" at 95c
24 "Bucking Bronchos" at 84c
15 "Tut-Tuts" at $1.05
24 Dancing Dolls at 24c

6. Wholesale furniture:

16 mahogany smoking cabinets at $2.48
8 buffet mirrors at $7.65
15 reed rockers at $11.25
35 oak chairs at $1.35
52 oak rockers at $2.25
24 kitchen tables at 98c
12 bentwood chairs at $4.20

EXERCISE No. 54, AUDITING

The seller should retain a copy of each invoice which he renders, to facilitate adjustments in case there is a misunderstanding, or in case the buyer should want to return some of the merchandise. This copy is usually made by placing a sheet of carbon paper between two invoices, or between an invoice and a sheet of blank paper. Writing on the invoice produces a copy of the writing, thus providing the seller with an exact copy of the invoice.

The following problems represent the seller's carbon copy of extensions in invoices rendered. A variety of merchandise is represented to familiarize you with merchandise sold by different lines of business. You are to verify each extension, prepare a written solution of those which are not extended correctly, and

show the correct total of all the items. Show your method of proof as well as the process of multiplication.

	Items	*Price*	*Amount*
a.	38 pocket knives	$ .32	$ 12.16
b.	66 pocket knives	.46	30.36
c.	42 Gillette razors	.88	36.06
d.	15 barrels of flour	7.25	108.25
e.	9 family tool chests	8.69	78.21
f.	12 dozen boys' tan shoes	12.65	153.80
g.	21 unbreakable "Mama Dolls"	1.69	35.49
h.	48 dozen Ivory soap	.68	32.64
i.	8 Crosley radio amplifiers	8.85	70.40
j.	15 kiddy scooters	1.65	24.25
k.	165 pounds of Red Ribbon butter	.45	74.25
l.	16 dozen pairs men's silk socks	7.65	132.40
m.	48 dozen dolls	9.99	479.52
n.	21 one-tube radios	6.81	133.01
o.	468 pounds of breakfast bacon	.32	149.76
p.	45 cases Safe Home matches	5.75	258.75
q.	35 dozen pairs ladies' hose	6.55	239.25
r.	655 pounds (25 kegs) 10d nails	.07	45.85
s.	25 pairs kid gloves	2.75	68.25
t.	15 smoking jackets	4.95	74.25
u.	31 Baldwin type "C" speakers	1.85	56.35
v.	7 "Recreator" radio horns	21.95	153.65
w.	525 sacks of salt	.05	26.25
x.	45 boxes of Red Cross soap	2.95	163.25
y.	28 kiddies road rippers	7.35	205.80
z.	56 men's ribbed sport coats	2.98	166.88
aa.	125 wooden cases	.85	106.25
bb.	48 pounds of Jones' sausage	.48	23.04
cc.	8 Aragon battery chargers	12.35	96.60
dd.	8 crystal radio sets	.88	7.04
ee.	48 bath towels	.79	35.92
ff.	92 kitchen tables	.98	90.16
gg.	250 natural "Mama Dolls"	.99	247.50
hh.	42 girls' moccasin style slippers	1.01	42.42
ii.	250 boxes Iodized Salt	.12	3.00
jj.	31 boxes Crane's Stationery #16	.57	17.67
	Total		?

EXERCISE No. 55, INVENTORY

The merchant buys merchandise and places it in stock for the convenience of his customers who wish to purchase it. When operating a business it is necessary for the merchant to maintain a stock of merchandise at all times. At various times, usually at the end of each year, he will want to ascertain the value of all merchandise he has in stock. This is known as *taking stock* and the list of merchandise resulting therefrom, as an *inventory*. The inventory contains a list of the merchandise and the price at which it is invoiced, usually cost, or market price if less than cost.

Problem 1 is an inventory of a retail merchant, taken on January 31; the other problems provide practice in preparing the inventory list and in making the extensions. The process of obtaining the value of each item, and the total of all items is the same as that of extending and adding an invoice.

1. R. T. Foreman, a retail grocer, had in stock on January 31, the merchandise given in the inventory below. You are to write the amount of each extension in a column, add, and show the total.

INVENTORY, JANUARY 31

173 lbs. Granulated Sugar	$ .06		
196 lbs. Brown Sugar	.05		
2 doz. Ivory Soap	.35		
2 doz. Blacking	.32		
26 lbs. Arbuckle Coffee	.18		
15 lbs. Tea	.27		
41 gal. Coal Oil	.10		
656 lbs. Bacon	.20		
500 lbs. Ham	.24		
1,388 lbs. Shoulder	.21		
117 lbs. Lard	.19		
24 doz. Cans Tomatoes	2.00		
35 gal. Syrup	.80		
5 bags Irish Potatoes	1.95		
25 bbls. White Lily Flour	8.85		
37 bbls. Fancy Flour	7.30		
78 lbs. Red Ribbon Butter	.35		
96 doz. Eggs	.40		
Total			

2. The Divine Piano Company had the following merchandise in stock on December 31: 187 music rolls @ 65c; 37 music rolls @ 80c; 29 music rolls @ $1; 67 music rolls @ $1.25; 215 pieces of music @ 16c; 118 pieces of music @ 18c; 27 pieces of music @21c; 2 pianos @ $272.50; 3 pianos @ $315.50; 4 pianos @ $450; 2 pianos @ $550. Show on tablet paper (a) the description of each item of merchandise and its value, and (b) the total value of all the merchandise.

3. The Jones Confectionery Company had in stock June 30, the following merchandise: 12 1-lb. boxes Johnson's candy @ 72c per lb.; 14 2-lb. boxes Johnson's candy @ 72c per lb.; 16 5-lb. boxes Johnson's candy @ 72c per lb.; 15 boxes A1 Cream Chocolates @ 85c per box; 215 lbs. mixed candy @ 17c; 15 lbs. mints @ 42c. Find the total value.

4. The Regan Radio Company had the following supplies in stock on September 30: 3 Crosley Head Phones @ $4.25; 8 Navy Head Phones @ $7.60; 14 spools No. 26 Green Silk Wire @ 88c per spool; 48 Porcelain Socket Tubes @ $26.50 per doz.; 3 DeForest Amplifiers @ $12.40; 5 DeForest Detectors @ $21.50; 12 Crystal Cups @ 48c each; 6 "A" Storage Batteries @ $15.50; 14 Silvertone Jr. Loud Speakers @ $17.50; 5 Music Box Crystal Sets @ $6. Find the value of the inventory.

In the two problems below, the figures in the first column represent the units, and in the second column, the price per unit. You are to ascertain the value of each quantity and the total.

5			6		
a. 88	@	$ .62	*a.* 347	@	$ .57
b. 269	@	.48	*b.* 714	@	.88
c. 478	@	.92	*c.* 279	@	.45
d. 527	@	.44	*d.* 826	@	.96
e. 686	@	.32	*e.* 559	@	1.13
f. 541	@	.14	*f.* 673	@	1.22
g. 722	@	.13	*g.* 821	@	.73
h. 361	@	1.25	*h.* 87	@	1.36
i. 462	@	1.18	*i.* 129	@	1.55

EXERCISE No. 56, AUDITING INVENTORY

You are to audit the extensions and addition of the inventory given on page 76 and report the errors. Find the total after you

have corrected the extensions, and show your figures in the extensions of those items which are incorrect.

1. Merchandise Inventory, February 28, 19..

350	lbs. Arbuckle Coffee	$ .15	56	50		
3,012	lbs. Granulated Sugar, per cwt.	4.80	144	58		
181	bxs. Domino Sugar	.21	38	81		
½	doz. bars Ivory Soap	.60		30		
81	doz. bars Star Soap	.39	27	59		
8	doz. cans Eagle Milk	1.35	40	80		
33	pkgs. Sun Maid Seedless Raisins	.16	5	28		
52	bxs. Crackers	.20	10	40		
528	lbs. Silver Leaf Lard	.19	106	32		
287	lbs. Breakfast Bacon	.20	57	40		
525	lbs. Premium Hams	.24	126			
5½	bbls. Roller King Flour	7.20	39	80		
3	bbls. Superior Flour	8.15	24	45		
60	lbs. American Cheese	.28½	15	35		
124	lbs. Red Ribbon Butter	.35	47	40		
22	cans Good Luck Baking Powder	.30	8	60		
2	doz. cans California Peaches	2.45	4	90		
15	doz. cans Del Monte Alaska Salmon	2.00	30			
1½	doz. cans Imperial Corn	2.00	3	50		
21	lbs. Sunset Prunes	.30	8	30		
86	bxs. Rice	.38	32	68		
62½	gal. Golden Glow Maple Syrup	.80	50			
82	doz. Eggs	.40	32	80		
5	doz. Lemons	.28	1	40		
65	bxs. Jello	.07	4	55		
2½	doz. Canned Asparagus	3.00	7	50		
7	doz. Canned Pineapple	2.25	15	75		
6	bxs. Cornflakes	1.00	6			
3	doz. Canned Cherries	2.15	16	45		
8	bbls. White Lily Flour	8.85	70	85		
4	bbls. Fancy Flour	7.30	29	20		
6	cases Pearl Soap	3.05	18	30		
16	bricks Badger Brick Cheese	.68	16	88		
2	buckets Candy	4.00	8			
3	bags Michigan Potatoes	1.95	5	85		
51	doz. bxs. Safe Home Matches	.47	24	72		
21	lbs. Powdered Sugar	.08	2	68		
49	gal. New Orleans Molasses	.69½	34	46		
18	bxs. Animal Cakes	.30	6	40		
	Value of Merchandise on hand				1,417	08

The figures in the first column of each of the following four problems represent the quantity; in the second, the price; and in the third, the extension. You are to (a) audit these extensions; (b) show in detail the calculations necessary to ascertain the correct amount in those which are wrong and (c), show the correct total of each problem.*

2			3		
a. 315 bu.	$1.10	$346.50	*a.* 225 lbs.	$ .11	$ 23.75
b. 439 gal.	.59	249.01	*b.* 13 bu.	1.50	19.50
c. 221 lbs.	.17	37.57	*c.* 371 lbs.	.15	55.65
d. 17 lbs.	.22	3.74	*d.* 413 lbs.	.10	42.20
e. 345 gal.	.78	279.10	*e.* 516 doz.	.25	128.00
f. 718 doz.	.88	632.84	*f.* 176 lbs.	.09	16.74
g. 954 bu.	1.09	939.86	*g.* 654 bu.	1.10	719.40
h. 87 gal.	.65	56.55	*h.* 315 gal.	.79	248.85
i. 231 doz.	.98	226.38	*i.* 710 doz.	.35	258.60
j. 652 bu.	1.50	978.00	*j.* 823 lbs.	.16	141.58
k. 82 lbs.	.29	24.78	*k.* 238 lbs.	.13	30.94
l. 110 lbs.	.15	16.50	*l.* 75 lbs.	.22	16.50

4			5		
a. 217 bu.	$1.10	$238.70	*a.* 115 lbs.	$ .11	$ 12.65
b. 67 bu.	1.15	77.10	*b.* 375 lbs.	.08	40.00
c. 28 bu.	1.50	43.00	*c.* 237 doz.	.68	151.16
d. 13 bu.	1.75	22.75	*d.* 451 gal.	.29	130.79
e. 123 lbs.	.16	19.68	*e.* 151 bu.	1.05	158.55
f. 435 lbs.	.27	116.35	*f.* 138 doz.	.15	30.70
g. 513 lbs.	.11	55.43	*g.* 561 doz.	.17	96.27
h. 249 lbs.	.06	14.94	*h.* 135 lbs.	.21	28.35
i. 587 lbs.	.05	29.35	*i.* 650 doz.	.20	130.00
j. 389 lbs.	.10	37.80	*j.* 548 lbs.	.19	104.12

EXERCISE No. 57, MAKING CHANGE

Making change in connection with a cash sale involves both multiplication and subtraction by addition as explained in Ex-

*NOTE: Unless the calculations are correct when a sale is made, the buyer or the seller will lose through the error. It is only fair that each should make the calculations and verify the amount of the sale. It is unfair to the buyer, if the seller observes an error in his favor and does not report it. It is just as unfair for the seller to take advantage of his customer in the same way.

ercise No. 32. Multiplication is necessary to ascertain the amount of the sale, and subtraction, to ascertain the amount of money due the customer, unless the amount tendered in payment is the exact amount of the purchase. The process is illustrated below.

You purchase six pounds of breakfast bacon at 42c per pound, and give the clerk three one-dollar bills in payment. The amount of the sale as indicated by correct multiplication is $2.52. He accepts the $3, places them in the cash register, and removes therefrom three cents, two dimes, and a quarter, and hands it to you counting 252, 253, 254, 255, 265, 275, $3. He arrives at the amount to take out of the cash register by the same mental process. In other words, instead of subtracting 252 from $3, and returning to you 48c in change, he arrives at the amount due you by counting the money beginning with the amount of the sale.

When the proper change is available, it is customary to make it with the least number of pieces. This plan was followed in the foregoing illustration. If the merchant had not had sufficient change to make it in this manner, he might have given you two nickels in place of one of the dimes, or a nickel and four dimes instead of the quarter and the dimes. In either case he would count the coins as he gives them to you. Thus, if he gives you three cents, a nickel, and four dimes, he would say 252, 253, 254, 255, 260, 270, 280, 290, $3.

The following problems provide oral practice in ascertaining the amount of a sale and making change:

1. 3 boxes of linen note paper at 50c per box;
   paid for with $2 bill.
2. 5 Eversharp pencils at 50c;
   paid for with three $1 bills.
3. 1 Icy-hot bottle for $2.19;
   paid for with a $5 bill. No quarters are available.
4. 5 lbs. of hard candy at 59c;
   paid for with a $5 bill.
5. 8 lbs. of stuffed dates at 59c;
   paid for with a $20 bill.
6. 1 five-lb. box of Johnson's chocolates, $3.75;
   paid for with a $10 bill.
7. 1 rubber-set brush at 98c;
   paid for with a $2 bill.
8. 2 military brushes at $3.78;
   paid for with a $10 bill.
9. 1 shaving mirror at 69c;
   paid for with a $1 bill.
10. 6 men's handkerchiefs at 11c;
    paid for with a quarter and a 50c piece.

CHAPTER VI

DIVISION

The purpose of the information in this chapter is to provide practice in division and in proving the results. The statements are made under the assumption that you understand the mathematical principles involved in the division process.

Division is the process of finding how many times one number is contained in another number. The number to be divided is the *dividend*; the number by which it is divided is the *divisor*; the number of times the divisor is contained in the dividend is the *quotient*; and if the divisor is not contained an equal number of times in the dividend, the number left over is the *remainder*.

The process of division, when applied to business problems, is usually indicated by the nature of the problems, and not by the usual sign of division, (÷).

EXERCISE No. 58, SHORT DIVISION

The process of division may be by one of two methods: (a) short division; and (b) long division. The short division process for dividing 84,276 by 12 is illustrated below at the left and the process for dividing 69,782 by 15 is illustrated at the right; in the one process there is no remainder and in the other there is a remainder.

12)84276

7023

Referring to the illustration at the left you will observe that 12 is contained in 84, 7 times, is not contained in 2, but is contained in 27, 2 times with a remainder of 3, and in 36, 3 times with no remainder. The quotient can be proved by multiplying 7,023 by 12; the product should be the dividend.

15)69782

4652-2R

In the process at the right 15 is contained in 69, 4 times with a remainder of 9, in 97, 6 times with a remainder of 7, in 78, 5 times with a remainder of 3, and in 32, 2 times with a remainder of 2; this remainder is indicated by the letter "R". The quotient can be proved by multiplying 4,652 by 15 and adding the 2; the sum of the product and the remainder should be the dividend.

The following problems provide written practice in short division, and illustrate the divisibility of numbers. Show all figures in your quotient as in the illustrations.

1	2	3
a. 3,486 ÷ 2	*a.* 3,264 ÷ 4	*a.* 7,626 ÷ 6
b. 1,278 ÷ 2	*b.* 9,244 ÷ 4	*b.* 4,837 ÷ 6
c. 9,832 ÷ 2	*c.* 1,484 ÷ 4	*c.* 8,634 ÷ 6
d. 4,782 ÷ 3	*d.* 3,405 ÷ 5	*d.* 4,837 ÷ 7
e. 2,346 ÷ 3	*e.* 3,290 ÷ 5	*e.* 8,323 ÷ 7
f. 6,846 ÷ 3	*f.* 6,380 ÷ 5	*f.* 5,734 ÷ 7

4	5	6
a. 3,819 ÷ 8	*a.* 4,653 ÷ 11	*a.* 3,262 ÷ 14
b. 4,653 ÷ 8	*b.* 5,786 ÷ 11	*b.* 4,637 ÷ 14
c. 2,781 ÷ 8	*c.* 5,748 ÷ 11	*c.* 5,642 ÷ 14
d. 4,689 ÷ 9	*d.* 2,784 ÷ 13	*d.* 5,735 ÷ 15
e. 3,798 ÷ 9	*e.* 6,344 ÷ 13	*e.* 1,905 ÷ 15
f. 8,392 ÷ 9	*f.* 8,151 ÷ 13	*f.* 7,290 ÷ 15

EXERCISE No. 59, LONG DIVISION

The process of long division requires the application of multiplication and subtraction, as indicated in the following problems; in short division these processes are required, but are performed mentally. The illustration below at the left shows the long division process for dividing 9,085 by 79, and the illustration at the right, the long division process for dividing 17,334 by 84.

```
  115
 ----
79)9085
   79
  ---
  118
   79
  ---
  395
  395
  ---
```

The illustration at the left shows the process of long division when there is no remainder, and the one at the right, when there is a remainder. The divisor is written at the left of the dividend and the quotient on a line above the dividend.

When there is a remainder, it is written at the right of the quotient, as in the illustration at the right.

```
206-30R
-------
84)17334
  168
  ---
   534
   504
   ---
    30
```

The problems at the top of page 81 provide written practice in long division. Your work on tablet paper should be arranged in the same manner as in the illustrations.

1	2	3	4
a. 1,568 ÷ 84	*a.* 4,268 ÷ 49	*a.* 8,165 ÷ 71	*a.* 844,806 ÷ 196
b. 3,978 ÷ 17	*b.* 4,275 ÷ 25	*b.* 8,125 ÷ 23	*b.* 527,843 ÷ 829
c. 7,280 ÷ 35	*c.* 3,384 ÷ 62	*c.* 7,776 ÷ 98	*c.* 115,972 ÷ 158
d. 7,668 ÷ 42	*d.* 4,368 ÷ 28	*d.* 5,460 ÷ 16	*d.* 961,053 ÷ 258
e. 4,784 ÷ 26	*e.* 1,586 ÷ 26	*e.* 3,625 ÷ 25	*e.* 135,280 ÷ 356
f. 6,120 ÷ 45	*f.* 4,608 ÷ 36	*f.* 8,658 ÷ 37	*f.* 126,624 ÷ 487

EXERCISE No. 60, PROOF OF DIVISION

The quotient in a division problem may be proved by multiplication or by check figures. When there is a remainder, it is necessary to add this to the product of the quotient and the divisor to prove the result.

The use of the check figure 9 to prove division (a) when there is no remainder, and (b) when there is a remainder is illustrated below. The check figure 11 can also be used for proving division. The illustration below shows the method of proving the division of 3,751 by 121 through the elimination of 9's.

```
   31                 The excess of 9's in 121 is 4.
  ----                The excess of 9's in 31 is 4.
121)3751              The product of 4×4 is 16.
  363                 The excess of 9's in 16 is 7.
  ---                 The excess of 9's in 3,751 is 7.
  121
  121
  ---
```

This proves the division in the solution at the left because the key figure resulting from eliminating the 9's from the product of the quotient and divisor is the same as the key figure resulting from eliminating the 9's from the dividend.

```
  31-103R
  -------
121)3854
  363
  ---
  224
  121
  ---
  103
```

When there is a remainder, the key figure resulting from the product of the key figures in the divisor and quotient, added to the key figure resulting from eliminating the 9's from the remainder should equal the key figure of the dividend. Applying this to the solution at the right, 4×4=16=key figure 7; eliminating 9's from 103 gives a key figure of 4; 7+4=11; eliminating the 9's gives the key figure 2; eliminating the 9's from 3,854 gives the key figure 2.

The problems at the top of page 82 provide written practice in division and the proof of division. You are to prove the first column by multiplication and addition, if there is a remainder; and those in the remaining columns by the check figure 9.

1	2	3	4
a. 4,268 ÷ 39	*a.* 685,525 ÷ 425	*a.* 473,827 ÷ 921	*a.* 622,080 ÷ 324
b. 4,275 ÷ 25	*b.* 738,472 ÷ 147	*b.* 684,990 ÷ 129	*b.* 573,841 ÷ 425
c. 3,384 ÷ 12	*c.* 362,746 ÷ 323	*c.* 473,823 ÷ 352	*c.* 473,821 ÷ 378
d. 4,637 ÷ 14	*d.* 263,120 ÷ 236	*d.* 948,371 ÷ 237	*d.* 948,573 ÷ 467

EXERCISE No. 61, DIVISION BY SUBTRACTION

One number may be divided by another by subtracting the divisor from the dividend. Continue the subtraction until the remainder is less than the subtrahend. The number of times it is necessary to subtract is the quotient.

```
400
129
---
271
129
---
142
129
---
 13
```

The illustration at the left shows the process of division by subtraction when the problem is 400 ÷ 129. You will observe that it is necessary to subtract three times, and after the third subtraction, there is a remainder of 13. This illustrates the fact that division is a short-cut method of subtraction.

The following problems provide written practice in division by subtraction. Show on tablet paper the subtraction in each problem arranged as in the illustration, and prove by long division.

1	2	3	4
a. 702 ÷ 56	*a.* 2,768 ÷ 346	*a.* 11,830 ÷ 2346	*a.* 143,764 ÷ 47,856
b. 675 ÷ 45	*b.* 5,124 ÷ 854	*b.* 54,391 ÷ 6785	*b.* 182,275 ÷ 36,455
c. 653 ÷ 36	*c.* 5,791 ÷ 643	*c.* 23,432 ÷ 5783	*c.* 111,544 ÷ 27,886
d. 450 ÷ 75	*d.* 2,315 ÷ 385	*d.* 24,988 ÷ 3568	*d.* 350,592 ÷ 58,432

EXERCISE No. 62, MULTIPLICATION BY DIVISION

Division may be used to advantage in multiplication when two, four, or eight times either the multiplier or multiplicand equals 1,000 or a multiple of 1,000. The illustration below shows the application of this method to ascertaining the value of 125 bushels of wheat at $1.44 per bushel.

```
  144
  125
------
  720
  288
  144
------
$180.00
```

The value of 125 bushels of wheat at $1.44 is $180. This is ascertained by multiplication, as shown at the left, or by multiplication and division, as shown at the right.

125 is contained in 1,000, eight times, hence 144 multiplied by 1,000 and divided by eight gives the same result as $1.44 multiplied by 125.

```
1000 ÷ 125 = 8
  144
 1000
------
8)144000
------
$180.00
```

The following problems provide oral practice in multiplication by division.

1	2
a. 17,648 bu. @ $1.25	*a.* 798 bu. @ $5.00
b. 464 bu. @ $2.50	*b.* 12,464 bu. @ $1.25
c. 1,250 lbs. @ 96c	*c.* 2,500 lbs. @ 75c
d. 1,464 bu. @ $1.25	*d.* 4,866 yds. @ $1.25
e. 500 lbs. @ $1.45	*e.* 892 yds. @ $1.25
f. 564 yds. @ $12.50	*f.* 4,132 lbs. @ $2.50
g. 2,500 yds. @ 14c	*g.* 654 bu. @ $1.25
h. 64,486 lbs. @ $1.25	*h.* 2,500 lbs. @ 57c
i. 67,384 lbs. @ $2.50	*i.* 1,250 yds. @ $1.25
j. 452 bu. @ $1.25	*j.* 4,236 bu. @ $1.25

EXERCISE No. 63, BILLING

The nature of the product and the method of packing often require division, as well as multiplication and addition in making the extensions of an invoice. Grain is usually shipped in sacks, and priced per bushel; hay, in bales, and priced per ton; coal, in cars or trucks, and priced per ton; lumber is cut in standard lengths, and priced per thousand board feet. When billing grain it is customary to state the quantity in pounds, and the price per bushel; hay, the quantity in pounds and the price per ton; and lumber, the quantity in board feet, and the price per thousand board feet.

The illustrations below show two processes of ascertaining the value of 2240 pounds of corn at 87c per bushel of 56 pounds.

```
      40
56)2240
   224

   .87
    40
$34.80
```

In the illustration at the left, the quantity is divided by the number of pounds in a bushel, and the price multiplied by the quotient.

```
   2240
    .87
  15680
 17920
1948.80
```

```
      $34.80
56)1948.80
   168
    268
    224
     448
     448
```

In the illustration at the right, the number of pounds is multiplied by the price per bushel, and the product divided by the number of pounds in a bushel. The quotient is $34.80 because the price per bushel is 87c.

The following problems provide written practice in making extensions and ascertaining the total of an invoice. When the price is per bushel or ton and the quantity stated in pounds, you are to show on tablet paper, both processes as given in the illustrations, one as the method of solution, and the other as a proof.

1. The Central Grain Exchange sold W. S. Fedders:

100 sacks (11,480 lbs.) No. 1 corn	97c
100 sacks (11,424 lbs.) No. 2 corn	93c
100 sacks (6,624 lbs.) oats	57c

NOTE: The price of corn is per bushel of 56 pounds and the price of oats is per bushel of 32 pounds.

2. The Shelley Grain Company sold the Jameson Grain Company:

50 sacks (5,824 lbs.) No. 1 corn	95c
50 sacks (5,936 lbs.) No. 2 corn	93c
50 sacks (3,296 lbs.) oats	57c

3. The Martin Feed Company sold L. J. DeVine:

25 bales (1,975 lbs.) No. 1 hay	$22.75
25 sacks (2,968 lbs.) No. 1 corn	.95
25 sacks (2,856 lbs.) No. 2 corn	.93

NOTE: The price of hay is per ton of 2,000 pounds. Multiply the price by the number of pounds and divide the product by 2; the product will be dollars and cents, the five figures at the right representing cents and fractions of a cent; $1,975 \times 22.75 = 4,493,125$; $4,493,125 \div 2 = \$22.46562 = \$22.47$.

4. The Martin Feed Company sold T. L. Dicken:

50 bales (4,827 lbs.) No. 1 hay	$22.25
40 sacks (4,480 lbs.) No. 1 corn	.97
20 sacks (2,408 lbs.) No. 2 corn	.91
25 sacks (1,728 lbs.) oats	.53

5. The Martin Feed Company sold C. H. Madison:

100 bales (9,427 lbs.) hay	$22.25
100 sacks (3,296 lbs.) oats	.55

6. The Central Coal Company sold J. L. Daly:

1 load (2,265 lbs.) lump coal	$7.45
1 load (2,487 lbs.) nut coal	7.15

NOTE: The price of coal is per ton of 2,000 pounds.

EXERCISE No. 64, AVERAGES

An average is obtained by dividing the sum of two or more items by the number of items added. Thus, if it is desired to ascertain the average sales made by a salesman during a week, the sales for each day will be added, and the sum divided by six; the quotient will be the average sales. If it is desired to ascertain the average number of hours worked by forty employees during a given period, divide the total number of hours all the employees worked, by forty.

Mon.	$156.50
Tues.	218.75
Wed.	74.65
Thurs.	128.80
Fri.	185.90
Sat.	91.60
	6)856.20
	$142.70

The illustration at the left shows the method of ascertaining the average sales made by James Kirk, a salesman, during a given week. Adding the daily sales and dividing by 6, gives $142.70, his average daily sales. If it is desired to compare the daily sales with the average, this is done by subtracting the daily sales from the average or the average from the daily sales. Thus, if the average is $142.70, and the sales on Monday are $156.60, the sales for this day are $13.80 above the average. On Wednesday the sales were only $74.65, so the sales for this day are $68.05 below the average.

The following problems provide written practice in determining averages, and in making comparisons.

1. Monday morning, Robert Dixon and family started on an automobile trip. The speedometer registered 9,674 miles before starting. On Monday night it registered 9,948 miles; Tuesday night, 10,207 miles; Wednesday night, 10,512 miles; Thursday night, 10,804 miles; Friday night, 11,078 miles; and Saturday night, 11,396 miles. Mr. Dixon wishes to know: (a) the actual number of miles traveled each day; and (b) the average number of miles traveled each day.

2. The sales for the Central Drug Company by months for the year were as follows: January, $2,345.02; February, $3,247.02; March, $2,749.54; April, $2,957.40; May, $4,123.95; June, $3,574.21; July, $2,450.73; August, $3,927.45; September, $3,547.20; October, $3,354.10; November, $3,752.30; December, $2,947.56. You are to find the average monthly sales.

3. A class of 16 students in arithmetic took a test and made the following grades: 86; 95; 73; 92; 89; 85; 82; 78; 86; 92; 98; 84; 72; 69; 78; 85. What was the average grade of the class?

4. J. A. Ross, an author, received royalty from his publishers over a period of six years. The first year the royalty was $786.45; the second year, $806.48; the third year, $882.25; the fourth year, $986.65; the fifth year, $1,035.68; and the sixth year, $1,129.41. You are to ascertain: (a) the total royalty received by Mr. Ross in the six years; and (b) the average yearly royalty.

5. The circulation for an afternoon paper in a certain city during one week was as follows: Monday, 11,462; Tuesday, 10,987; Wednesday, 12,455; Thursday, 11,009; Friday, 9,087; and Saturday, 16,214. You are required to show: (a) the average daily circulation; and (b) a comparison of circulation for each day with the average. Mark the amounts which are below the average by a minus sign, and the amounts which are above the average by a plus sign.

6. Department A of the Brown Manufacturing Company had twelve employees. During one week the time worked by all the employees was as follows: Monday, 103 hours; Tuesday, 102 hours; Wednesday, 97 hours; Thursday, 94 hours; Friday, 101 hours; and Saturday, 67 hours. You are to ascertain: (a) the average number of hours worked; and (b) compare the time of the following employees with this average; No. 1, 51 hours; No. 2, 48 hours; No. 3, 40 hours; and No. 4, 44 hours.

NOTE: The management is interested in each employee working the maximum number of hours, because the expense of maintaining space, heat, light, etc. for each employee goes on just the same whether he works or not. An employee who cannot work approximately the average time, should be replaced by one who can do so.

7. The weight of each player on two college football teams was as follows:

Eastern College: 178 lbs., 162 lbs., 159 lbs., 154 lbs., 146 lbs., 137 lbs., 149 lbs., 156 lbs., 148 lbs., 144 lbs., 139 lbs.

Western College: 158 lbs., 152 lbs., 148 lbs., 141 lbs., 142 lbs., 140 lbs., 134 lbs., 136 lbs., 137 lbs., 133 lbs., 174 lbs.

Find (a) the total weight of each team, (b) the average weight of each team, and (c) the difference between the average weights of the teams.

8. According to the bookkeeping records, the cost of operating the business of J. L. Holland during a certain year was as follows: January, $854.25; February, $783.55; March, $825.47; April,

$906.78; May, $867.66; June, $798.83; July, $678.42; August, $754.45; September, $834.67; October, $805.26; November, $756.55; December, $782.47. It is desired to know (a) the average monthly expenses, (b) the comparison of each month with this average and, (c) the comparison showing the increase or decrease, indicated by a plus or minus sign.

EXERCISE No. 65, DISTRIBUTION OF OVERHEAD EXPENSE

A manufacturer must know the cost of the products of his factory in order to fix a selling price which will provide sufficient profit to justify the operation of the factory. There are three principal elements in the cost: (a) raw material; (b) labor; and (c) overhead, or manufacturing expense. *Raw material* refers to the articles needed in the manufacture of the product; *labor* refers to the wages paid to the employees to operate the machines or do hand work; *overhead expense* includes, the superintendent's salary, the foreman's salary, rent, heat, light, and other expenses which are a part of the direct manufacturing cost.

The following problems provide written practice in distributing monthly overhead expenses. No. 1, requires the distribution of the rent in accordance with the number of square feet in each department, as given in the five columns at the right. No. 2, requires the distribution of the superintendent's salary on a basis of the number of hours produced in each department. No. 3, requires the distribution of the bill for lighting on a basis of the number of lamps in each department. No. 4, requires the distribution of the power used for the machines on a basis of the horse power used in each department. No. 5, requires the distribution of the towel cost on a basis of the number of employees.

			a	*b*	*c*	*d*	*e*
1.	Rent, $500.00.	Square feet	1,650	1,040	950	960	400
2.	Salary, $300.00.	Prod. hours	1,450	1,590	1,620	950	390
3.	Light, $88.00.	No. lamps	29	27	21	16	17
4.	Power, $490.56.	Horse power	262	256	250	240	160
5.	Towels, $12.80.	No. employees	30	25	25	22	26

To distribute the $500 rent, ascertain the total number of square feet by adding the number of square feet in each department; divide this into the amount paid for rent to ascertain the cost per square foot; and multiply the number of square feet in each department by the rate per square foot. Follow the same plan for distributing the superintendent's salary, cost of light, cost of horse power, and the cost of the towels.

EXERCISE No. 66, FACTORS

An *integer* is a whole number such as 1, 4, 9, etc. A *prime number* is one that is divisible only by 1 and itself, as 7, 11, 13, 37, etc. A *composite number* is one that is divisible by other numbers in addition to one and itself, as 4, 18, 48, etc. A *factor* of a number is a divisor of that number. A *prime factor* is a prime number. An integer that is divisible by two is an *even number;* all other integers are *odd numbers.*

When it is desired to separate a number into its factors, it is necessary to divide by the factors. The following facts regarding the divisibility of numbers will be of assistance in factoring: (a) 2 is contained in all even numbers; (b) 3 is contained in a number if the sum of the digits is divisible by 3; (c) 4 is contained in a number if the number expressed by the last two digits is divisible by 4; (d) 5 is contained in any number ending with 0 or 5; (e) 6 is contained in any number that is divisible by both 2 and 3; (f) 8 is contained in a number if the number expressed by the last three digits is divisible by 8; (g) 9 is contained in a number, if the sum of the digits is divisible by 9.

2)1716
2)858
3)429
11)143
13

The illustration at the left shows the process of separating 1,716 into its prime factors. You will observe that to do this it is necessary to divide by a prime factor and continue dividing by a prime factor until the last quotient is a prime number. Completing the division, you ascertain the prime factors of 1,716, which are 2, 2, 3, 11, 13.

The following problems provide written practice in factoring, and applying the divisibility of numbers. You are to show on tablet paper the prime factors of each number, arranging your work in the same order as in the illustration.

1	2	3	4	5
a. 2,048	*a.* 68,544	*a.* 73,260	*a.* 378,000	*a.* 874,874
b. 6,561	*b.* 38,625	*b.* 27,930	*b.* 599,676	*b.* 356,250
c. 9,375	*c.* 28,980	*c.* 30,030	*c.* 498,498	*c.* 273,564
d. 6,930	*d.* 25,344	*d.* 26,100	*d.* 470,475	*d.* 327,978

A factor or divisor common to two or more integers is called a *common factor* or *divisor.* The greatest common divisor (g. c. d.) is the largest factor that is common to two or more given numbers; thus, 8 is the greatest common divisor of 16, 24, and 32, because it is the largest number that will exactly divide all the numbers.

EXERCISE No. 67, MULTIPLES

A *multiple* of a number is an integral number of times that number. A *common multiple* of two or more numbers is a number that is a multiple of each. The *least common multiple* (l. c. m.) of two or more numbers is the least number that is a multiple of each.

22 is a multiple of 11, because 2, one integer, multiplied by 11, another integer, equals 22. 16 is a common multiple of 8 and 4, because either of these integers multiplied by some other integer will equal 16. 30 is the least common multiple of 5, 6, 10, 15, because any of these integers multiplied by some integer will equal 30, and 30 is the least number which will contain each of them without a remainder.

When it is desired to ascertain the least common multiple of two or more numbers, it is necessary to separate each number into its prime factors, and ascertain the product of the factors.

$16 = 2 \times 2 \times 2 \times 2$
$30 = 2 \times 3 \times 5$
$32 = 2 \times 2 \times 2 \times 2 \times 2$
$2 \times 2 \times 2 \times 2 \times 2 \times 3 \times 5 =$
480, the l. c. m.

The illustration at the left shows one of the processes of finding the least common multiple of 16, 30, and 32. Each number is first separated into its prime factors. The product of these factors is then found by using each factor the greatest number of times it occurs in any one of the given numbers.

The illustration at the right shows another method of securing the least common multiple of 16, 30, and 32. The numbers are divided by any prime number that will exactly divide two or more of them. 16, 30 and 32 are divisible by 2. 15 is not divisible by 2, so this is brought down. The least common multiple is the product of all the divisors and the last quotients.

$$\begin{array}{r} 2)16-30-32 \\ \hline 2)8-15-16 \\ \hline 2)4-15-8 \\ \hline 2)2-15-4 \\ \hline 1-15-2 \end{array}$$

$2 \times 2 \times 2 \times 2 \times 15 \times 2 =$
480, the l. c. m.

The following problems provide written practice in finding the l. c. m. of a series of numbers.

1	2	3
a. 12, 15, 18	*a*. 12, 25, 27, 32	*a*. 14, 28, 21, 49
b. 16, 24, 28	*b*. 14, 81, 35, 15	*b*. 16, 32, 48, 28
c. 25, 28, 30	*c*. 24, 36, 60, 48	*c*. 32, 48, 35, 70
d. 36, 42, 48	*d*. 36, 75, 48, 24	*d*. 40, 30, 65, 48

EXERCISE No. 68, CANCELLATION

Cancellation refers to the elimination of factors in the divisor and dividend before dividing. The quotient is not affected by the elimination of factors which are common to both dividend and divisor. The illustrations below show the solution of 20,338 ÷5,648 with and without cancellation.

```
          36
      ------
5648)203328
     16944
     -----
      33888
      33888
      -----
```

The solution at the left shows long division without cancellation. The process is the same as in previous exercises given in long division.

The solution (a) at the right shows the dividend factored; (b) shows the divisor factored; and (c) the division by cancellation. It is not necessary to separate the numbers into their prime factors, hence the divisibility of numbers, explained in a previous exercise may be applied. After factoring, the factors of the dividend are written above the line, and the factors of the divisor below the line. Since 8 and 353 occur both above and below the line, these may be cancelled. 2 is contained in 8, 4 times. 9 times 4 are 36, the same as the answer obtained by long division.

(a) $20338 = 9 \times 8 \times 8 \times 353$

(b) $5648 = 2 \times 8 \times 353$

(c) $$\frac{9 \times \cancel{8} \times \overset{4}{\cancel{8}} \times \cancel{353}}{\cancel{8} \times \cancel{2} \times \cancel{353}} = 36$$

The following problems provide written practice in division by cancellation. Prove the problems in Nos. 1 and 3 by long division, and the problems in Nos. 2 and 4 by multiplication.

1	2
a. 49,248 ÷ 2,736	*a.* $(8 \times 8 \times 907) \div (2 \times 2 \times 907) =$
b. 38,100 ÷ 2,540	*b.* $(7 \times 7 \times 7 \times 7 \times 7 \times 4) \div (7 \times 7 \times 7 \times 7 \times 2) =$
c. 58,368 ÷ 3,648	*c.* $(6 \times 6 \times 4 \times 4 \times 4 \times 19) \div (6 \times 6 \times 4 \times 19) =$
d. 38,486 ÷ 2,749	*d.* $(7 \times 8 \times 4 \times 3 \times 37) \div (7 \times 4 \times 3 \times 37) =$
e. 76,125 ÷ 3,045	*e.* $(5 \times 6 \times 6 \times 8 \times 24) \div (6 \times 5 \times 3 \times 8) =$

3	4
a. 52,800 ÷ 3,520	*a.* $(4 \times 3 \times 8 \times 32) \div (2 \times 2 \times 16 \times 3) =$
b. 36,864 ÷ 1,152	*b.* $(81 \times 16 \times 10 \times 12) \div (9 \times 27 \times 2 \times 5) =$
c. 32,768 ÷ 2,048	*c.* $(31 \times 28 \times 19 \times 80) \div (7 \times 19 \times 2 \times 10) =$
d. 38,367 ÷ 1,827	*d.* $(63 \times 49 \times 21 \times 13) \div (3 \times 7 \times 9 \times 7) =$
e. 90,384 ÷ 3,228	*e.* $(42 \times 36 \times 88 \times 22) \div (11 \times 6 \times 22 \times 21) =$

CHAPTER VII

PRACTICAL PROBLEMS

The purpose of the following problems is to provide additional practice in applying the four fundamental operations of arithmetic to the solution of business problems.

1. The distance from New York to Chicago is 998 miles; from Chicago to Omaha, 488 miles; Omaha to Cheyenne, 507 miles; Cheyenne to Ogden, 483 miles; Ogden to San Francisco, 783 miles. What is the distance from New York to San Francisco?

2. Omaha is 1,033 feet above sea level; Chicago is 590 feet above sea level; and Denver is 4,149 feet higher above sea level than Omaha. How much higher is Denver than Chicago?

3. Denver is 5,182 feet above sea level; Death Valley, California, is 271 feet below sea level. How much higher is Denver than Death Valley?

4. The following is the income for the United States Government for two consecutive years. You are to ascertain the total receipts for each year, and the increase or decrease for the second year.

	First Year	Second Year
Distilled spirits	$ 25,902,820.28	$ 27,580,380.64
Fermented liquors.....	1,954.44	5,373.50
Tobacco manufactures...	345,247,210.96	325,638,931.14
Oleomargarine.....	3,038,927.84	2,914,104.14
Capital stock tax.....	95,814,152.60	95,286,105.44
Miscellaneous.....	344,738,257.14	490,676,910.89
Internal Revenue Stamps	7,738,895.47	12,418,180.25
Income and profit taxes..	1,761,695,099.51	1,841,759,316.80

5. Robert Fisher sold his home for $11,764, his store for $16,145, his stock at the inventory price, for $26,381, and received $20,000 as first payment. For the remainder he received farm land at $45 per acre. How many acres did he receive?

6. According to the fundamental principles of bookkeeping, the total resources should equal the sum of the total capital and the liabilities. Add and prove the following bank statement.

BROTHERHOOD NATIONAL BANK

Report of condition at the close, on December 31, 19...

RESOURCES

Loans and discounts	$1,400,241.60
Overdrafts, secured $200.06, unsecured $459.32	659.38
U. S. Government securities owned:	
Deposited to secure circulation	200,000.00
All other Government securities	13,043.00
Other bonds, stocks, securities, &c	1,658,890.15
Furniture and fixtures	49,019.59
Lawful reserve with Federal Reserve Bank	127,313.24
Cash in vault and due from national banks	168,569.65
Amount due from banks	4,457.26
Exchanges for clearing houses	46,562.94
Miscellaneous cash items	3,081.00
Redemption fund deposited with U. S. Treasurer	10,000.00
Other assets	38,593.12
Total resources	

LIABILITIES

Capital stock paid in	$ 200,000.00
Surplus fund	50,000.00
Reserved for taxes, interest, &c. accrued	5,765.43
Circulating notes outstanding	200,000.00
Amount due to national banks	37,826.28
Certified checks outstanding	9,569.27
Cashier's checks outstanding	16,066.41
Demand deposits	577,600.34
Certificates of deposit due in less than 30 days	9,596.66
Other Certificates of deposit	37,036.00
State, county or other municipal deposits	300,000.00
Other time deposits	2,272,689.82
Liabilities other than those above stated	4,280.72
Total Capital and Liabilities	

7. The daily sales of a high school cafeteria for the week ending March 17 were as follows: Monday, $92.65; Tuesday, $91.87; Wednesday, $93.44; Thursday, $95.14; Friday, $89.50. What was the average sales for the five days?

8. Ascertain the total amount necessary to purchase the following items. Show on tablet paper the amount of each purchase and the total.

2 doz. eggs at 49c
3 lbs. coffee at 48c
5 lbs. meat at 39c
11 yds. percale at 29c
25 lbs. sugar at 9c
24 lbs. sweet potatoes at 6c
1 bx. aspirin at 39c
1 bottle listerine at 79c
2 pkgs. figs at 18c
15 lbs. parsnips at 5c
12 lbs. apples at 4c
20 lbs. potatoes at 6c

9. The Dry Fuel Co. bought 500 cords of wood at $11 per cord. Sold 200 cords at $14, 100 cords at $14.75, and the remainder at $10 per cord. (a) Did they gain or lose? (b) How much? (c) If the expense of delivery was 25c per cord, what was the net gain or loss?

10. A truck loaded with coal weighed 14,025 pounds. The truck weighed 4,985 when it was empty. At 80 pounds per bushel, how many bushels of coal did it contain?

11. A. L. Davis paid $22,500 for a farm and sold it for $25,675. What was his profit after paying $770.25 commission to the agent making the sale?

12. The following sales were made during the first six months of the year by a department store. Ascertain the information that should be in the blank spaces and prove the results by cross addition.

Month	Books	Shoes	Hats	Silks	Notions	Total
Jan.	$1,275.47	$1,581.65	$985.68	$1,845.69	$825.15	
Feb.	1,389.05	1,421.79	925.42	2,021.45	782.28	
March	1,299.75	1,507.31	896.25	2,124.22	806.21	
April	1,403.88	1,487.64	947.72	1,732.48	847.31	
May	1,348.78	1,757.46	963.13	1,921.42	356.25	
June	1,357.21	1,645.25	894.50	1,876.42	825.42	
Total						

13. The following pay roll sheet shows the time for the twelve employees of the Crown Manufacturing Company during a certain week. Each employee is paid 78c per hour with time and a half for overtime; that is, for time in excess of eight hours for the first five days in the week, and four hours on Saturday.

PAY ROLL SHEET

	Mon.		Tues.		Wed.		Thurs.		Fri.		Sat.		Reg. Time		Over-time	
Emp.	hrs.	min	h.	m.	h.	m.	h.	m.	h.	m.	h.	m.				
# 1	9	30	8	00	10	00	9	30	8	30	7	30				
2	9	30	8	30	11	00	10	30	9	30	6	00				
3	10	30	10	30	9	30	8	30	10	00	5	00				
4	9	30	10	00	9	30	11	00	8	00	7	00				
5	9	30	8	30	10	30	8	00	11	00	7	30				
6	9	00	9	30	11	00	10	00	9	30	4	00				
7	8	00	10	30	10	00	9	30	11	00	6	00				
8	10	00	9	30	8	30	11	00	9	30	6	30				
9	9	30	11	00	10	00	9	00	8	30	4	00				
10	9	30	9	30	10	30	9	30	11	00	5	00				
11	10	30	8	00	9	30	11	30	9	00	7	30				
12	10	00	10	30	11	00	8	30	9	30	7	30				
											Total					

You are required to find: (a) the amount due each employee, allowing overtime for time worked in excess of eight hours each day, except Saturday, and in excess of four hours on Saturday—show regular time and overtime in separate amounts; (b) the amount due all the employees for the week—show the regular time and overtime in separate amounts; (c) the average time of each employee for the week; (d) a comparison of each employee's

time with the average, indicating those above the average with a plus sign and those below the average with a minus sign; (e) the average overtime for the week with a comparison of each employee's overtime with this; (f) the average earnings; and (g) prepare a change sheet showing the number of pieces of the various denominations of currency which the paymaster must secure from the bank in order to have sufficient change to place the amount due each employee in envelopes.

14. An automobile which cost $1,260 was traded in at the end of three years for a new automobile, and the owner was allowed $510 for it. What was (a) the total loss on the car due to depreciation during the three years, (b) the loss per year?

15. The Busy Bee Department store has four departments with space as follows: Department A, 1,250 square feet; Department B, 1,800 square feet; Department C, 3,750 square feet; and Department D, 2,200 square feet. It is desired to know the departmental charge for the monthly rent of $720 per month.

16. You are given a $5 bill to purchase from a grocery store the following items: 6 lbs. of sugar at 9c; 1 loaf of bread at 15c; 2 lbs. of prunes at 45c per lb.; 2 lbs. of butter at 42c per lb.; and 2 cans of peaches at 38c each. What amount of change should you receive, and in what denominations?

17. The report of a restaurant for one day is given below. Find the average price spent for a meal.

12 meals at 20c; 18 meals at 25c; 24 meals at 30c;
25 meals at 35c; 56 meals at 40c; 55 meals at 45c;
10 meals at 50c; 14 meals at 55c; 13 meals at 65c;
12 meals at 70c; 10 meals at 80c; 9 meals at 95c.

18. The Cambria Manufacturing Company had raw material to the value of $14,467.75 in stock on January 2. During the year, the raw material account showed the total purchases as $42,561.99; the cost of labor during the year was $14,461.90; and the overhead expenses were $14,378.55. At the end of the year the inventory of raw material was $18,261.54. Ascertain from these figures the cost of the manufactured goods sold during the year.

NOTE: Add the first four amounts and subtract the fifth amount from their sum.

The prices in the two problems below are quoted from an after Christmas bargain sale. You are to ascertain (a) the saving on each article, and (b) the total saving if one customer bought one each of the articles in problem 19, and problem 20.

19.	20.
$3.75 Sheets at $2.90	25c Irish crash, yd. 19c
$4.75 Sheets at $3.89	50c Irish crash, yd. 39c
$5.00 Sheets at $3.98	29c Linen crash, yd. 22c
$5.50 Sheets at $4.29	$2.50 Damask, yd. $1.69
$1.25 Sheets at $1.05	$1.50 Table padding, yd. 98c
$1.65 Sheets at $1.29	35c Turkish towels 25c
$1.79 Sheets at $1.39	42c Turkish towels 33c
$5.00 Napkins at $3.98	50c Turkish towels 39c
$1.25 Damask at 89c	69c Turkish towels 49c
$4.50 Napkins at $3.59	$6.00 Napkins at $4.59
$6.50 Napkins at $4.98	$4.25 Sheets at $3.39
$7.50 Napkins at $5.98	$1.85 Sheets at $1.59
$10.00 Napkins at $6.98	$10.00 Bed Sets at $7.59
$7.00 Bed Sets at $4.98	$5.25 Table Cloths at $4.45
$4.50 Bed Sets at $3.25	$7.35 Table Cloths at $6.58

21. A. Y. Burroughs lives at the corner of Main and Oak Streets. His lot fronts 100 feet on Main Street and 200 feet on Oak Street on the inside of the walk. What will it cost to erect a wire fence between him and his neighbors on the side and on the back at $1.05 per foot?

22. What will it cost him to put down a new cement sidewalk 6 feet wide on both Oak and Main Streets at $2 per square yard?

23. He has a back porch which is 15 feet long and 5 feet wide. What will the lumber to refloor this cost at $42.50 per thousand? Each piece of flooring is six inches wide, but being tongued and grooved, only five inches of surface is obtained out of each six inch width. (See note under problem 48 on page 104.)

24. That portion of Main Street on which his house faces has been made an improvement district, and is to be repaved. The cost of paving the 100 feet owned by Mr. Burroughs is $2,761.50. The amount of Mr. Burrough's share is one half of that to be paid by the city. He is to have the option of paying his share in five equal installments. What is (a) his total share, and (b) the amount of each installment?

25. The total valuation of public utilities in Ohio during two consecutive years is shown in the following table:

	First Year	Second Year
Steam railroad companies	$839,465,430	$826,683,420
Street, suburban and interurban	179,506,770	183,440,700
Natural gas companies	113,572,550	118,552,250
Artificial gas companies	1,481,100	845,630
Telephone companies	127,047,580	119,512,590
Electric light companies	208,592,280	178,035,090
Waterworks companies	6,164,370	6,076,570
Pipe line companies	26,250,480	28,306,650
Messenger and signal companies	1,088,750	1,069,270
Heating and cooling companies	321,920	303,570
Express companies	1,943,370	1,931,530
Telegraph companies	9,933,950	9,325,600
Water transportation companies	396,490	2,472,930
Union depot companies	4,552,190	3,950,560

You are to ascertain (a) the total valuation for the first year, (b) the total valuation for the second year, and (c) the increase or decrease in the total valuation.

26. During a certain business year the sales of the Fox Mercantile Company were $24,721.40. The merchandise in stock at the beginning of the year was valued at $6,241.82, the purchases during the year were $15,265.92, and the merchandise remaining in stock at the end of the year was valued at $4,427.35. How much did the Fox Mercantile Company make on the sale of its merchandise?

27. J. H. Grusen accepted bids on the construction of a home as follows: foundation, $2,181.45; lumber, $4,216.50; brick, $955.15; construction of house including roof, $3,917; plastering, $1,845.50; painting, $965.05; plumbing, $1,842.50; electric wiring, $722.95. You are to ascertain the total cost of the house based on these accepted bids.

28. J. B. Reed reported the following facts regarding an automobile trip: speedometer reading at the beginning of the trip, 21,121; speedometer reading at the end of the trip, 29,507; number of gallons of gasoline in tank at the beginning of the trip, 18; number of gallons of gasoline purchased, 592; number of gallons of gasoline in tank at the conclusion of the trip, 11. You are to ascertain (a) total number of miles traveled, (b) number of gallons of gasoline used, and (c) the average number of miles per gallon.

29. The information given in the table below is from a report published by the Federal Reserve Bank in New York City at the close of a certain year. You are to ascertain (a) the total New Capital, (b) the total Refunding, and (c) the difference between the two.

	New Capital	Refunding
Railroads	$ 369,745,730	$124,853,000
Public utilities	1,449,510,304	226,266,300
Industrials—		
Iron, steel, coal, copper	194,992,500	21,496,000
Equipment manufacturers	13,840,000	.....
Motors and accessories	191,136,721	22,241,389
Other industrials and manufacturing	453,435,108	79,281,400
Oil	147,857,528	114,180,810
Land, buildings, etc.	700,056,050	38,173,000
Rubber	49,485,000	800,000
Shipping	33,604,895	4,315,225
Miscellaneous	336,152,776	21,497,000
Municipal	1,271,779,485	46,156,232
Canadian brought out in U. S.	38,658,000	96,797,000
U. S. Territories and possessions	8,815,000	.....
Foreign governments	601,781,000	134,600,000
Farm loan issues	127,353,100	19,527,900
Canadian corporations	85,195,000	21,016,000
Other foreign corporations	388,765,000	.....
Total	4621 63197	712022

30. The total advertising cost of the Ideal Store for the month of August was $7,500. It is desired to distribute this on a $100 unit basis over five departments of the store in accordance with the sales in each department which are as follows: Department No. 1, $12,408.53; Department No. 2, $14,923.25; Department No. 3, $14,001.54; Department No. 4, $16,045.30; Department No. 5, $17,689.50.

To distribute the cost of advertising over the various departments on a one hundred dollar unit basis means that instead of using the actual amount of the sales in making the distribution, the nearest even hundred dollars will be used. Thus, the sales in department No. 1, will be regarded as $12,400, or 124 hundred dollar units; the sales in department No. 5, as $17,700, or 177 hundred dollar units. The total sales for all departments on this unit basis is 750 hundred dollar units. $7,500 ÷ 750 equals $10 to be charged to each department on each hundred dollars of sales for the department.

31. On March 7, Brown Brothers, manufacturers of men's clothing, received an order from A. L. Day, one of their customers.

The order was referred to the shipping clerk with instructions to pack and ship, and give the office a statement of the weights so that proper instructions could be given the transportation company, also so that Mr. Day can be sent a copy to check against the shipment when received. After packing the order the shipping clerk reported that it required twenty cases to contain the merchandise shipped. The weights in pounds of these cases were as follows: 256, 319, 408, 271, 400, 356, 445, 485, 316, 389, 412, 487, 365, 358, 427, 475, 247, 268, 349, and 285. The cases were numbered in the order given, beginning with one, and the number and weight written on the outside of each case. You are to prepare a list showing the number of each case, the weight, and the total weight of all the cases to be attached to the invoice sent to Mr. Day. When the merchandise is received, he will check the cases by number and by weight as given on this list, and the total weight with the freight bill which he receives from the railroad.

32. The distance between Denver and Washington, D. C., by one route, is 1810 miles, between Denver and Chicago is 1,022 miles; and between Denver and Pittsburgh is 1,490 miles. What is the distance between: (a) Pittsburgh and Chicago; (b) Pittsburgh and Washington, D. C.; and (c) Chicago and Washington?

33. Below is given in the first two columns the Treasury receipts of the United States Government for two consecutive months, and in the other two columns the receipts for two consecutive years. You are to ascertain the total of each of the four columns and prove by reverse addition.

Receipts	a	b	c	d
Customs	$31,035,094.56	$25,909,177.05	$229,157,479.87	$215,123,708.16
Income and profit taxes	18,914,893.85	16,716,628.22	486,687,239.35	448,030,222.79
Misc. internal revenue	47,630,967.35	44,344,105.06	384,581,260.63	353,462,360.18
Foreign principal	.....	3,544.63	178,742.75	150,738.94
Foreign interest	164,169.06	171,441.10	10,424,974.58	10,883,202.62
Railroad securities	1,924,460.53	11,814,380.68	13,663,282.74	100,036,791.13
All others	1,851,918.90	2,421,420.41	13,182,253.11	3,366,352.61
Trust fund receipts	1,211,880.89	1,651,102.71	14,371,253.09	12,508,296.28
Sale surplus property	583,549.35	347,814.30	6,349,104.31	9,882,508.89
Panama Canal tolls	2,059,964.42	1,667,121.64	9,053,661.71	9,752,386.78
Rec. from misc. sources	1,496,755.92	1,080,796.22	8,882,811.44	9,900,746.20
Other miscellaneous	8,465,616.77	8,460,300.31	60,985,079.60	65,670,236.14
TOTALS				

34. The Trial Balance below was prepared from a ledger which was in balance, but the Trial Balance is not in balance, because the bookkeeper failed to transfer from the ledger the amount of the Sales Returns; that is, the total of the various amounts of merchandise returned by customers. Copy the Trial Balance writing Sales Returns between the Sales and Inventory, leaving the amount column blank. Add each column and take the difference. Write this difference in the column that is smaller and on a line with Sales Returns. The totals of the two columns of the Trial Balance should now be the same, thus proving that the ledger is in balance.

Trial Balance, December 31, 19..

Ledger Page		Debits		Credits	
1	Cash	1532	17		
1	Notes Receivable	1345	65		
2	Accounts Receivable	2353	01		
2	Reserve for Doubtful Accounts	10	01	19	19
4	Furniture and Fixtures	684			
4	Reserve for Depreciation of Furniture			34	20
6	Buildings	6000			
6	Reserve for Depreciation of Buildings			345	
7	Land	4000			
8	Office Supplies	301	25		
8	Insurance	190	96		
9	Notes Payable			1795	82
9	Accounts Payable			2081	39
11	Charles Cook, Capital			5000	
11	Thomas Duggan, Capital			5000	
12	Sales			26783	12
14	Inventory	2198	71		
15	Purchases	20280	51		
15	Purchases Returns and Allowances			411	85
16	Selling Expense	1520	65		
17	Administrative Expense	1325	83		
18	Interest Earned			151	11
18	Purchases Discount			520	36
19	Interest Cost	91	72		
19	Sales Discount	64	75		

35. The population of Chicago is 2,701,705; of the State of Illinois is 6,485,280; of Springfield is 59,183; Rockford is 65,651; and Peoria is 76,121. What is the difference between (a) the

population of Chicago and the sum of the population of the other three cities; (b) the population of the State of Illinois and Chicago; (c) the population of Peoria and Springfield; and (d) the population of Chicago and Springfield?

36. J. L. Dix operated a retail hardware store for a year and at the end of that time wished to know his profit or loss from the operation of the store. During the year he kept a record of: (a) each purchase of merchandise; (b) each sale of merchandise; (c) each expense in connection with the operation of the store. This record showed the total purchases as $14,562.75, total sales as $20,904.78, and total expenses as $6,752.06. At the end of the year, December 31, he had merchandise on hand that had not been sold valued at $3,487.55. What was his net profit from the operation of the store?

The total purchases, minus the goods not sold, equal the cost of goods sold; the sales, minus the cost of the goods sold, equal the profit on sales; and the profit on sales, minus the expenses, equals the net profit.

37. During the following year Mr. Dix maintained a record of purchases, sales and expenses, the same as the first year. At the end of the second year his records showed: purchases, $16,786.49; sales, $23,907.18; and expenses, $7,409.85. The merchandise in stock at the end of the year was valued at $3,892.76. (a) What was his net profit the second year? (b) How did it compare with the preceding year?

You will observe that he had some merchandise on hand at the beginning of the year which should be added to the cost of the goods bought during the year to ascertain the total purchases.

38. A. F. Allen earned $356.50 during August. During September he earned $39.75 more than in August, and in October he earned as much as he did during August and November. If he earned $150.00 in November, how much did he earn in: (a) September, (b) October, and (c) during the four months?

39. A. L. Downing has a lot 250 feet long and 120 feet wide. William Dale contracts to dig a ditch 4 feet wide and 3 feet deep around the lot, the outer edge of the ditch being inside the lot 1 foot from the division line. The contract price is 3c per cubic foot. How much will Mr. Dale receive for his work?

40. The following advertisement of bargains appeared in a daily newspaper of a certain large city.

Quantity	ARTICLE	Marked Price	Sale Price
1,415 Yds.	Plain and Fancy Satin Taffetas, Tub Silks and Rayon Fabrics, per yard.....	$1.89	$1.10
975 Yds.	Crepe de Chine, Taffeta, Satin Foulards, tub silk, etc. Special, per yard	$2.25	$1.25
795 Yds.	Knitted Rayon Tricolet, black and navy, for dresses, slips, per yard.....	$1.25	65c
375 Yds.	50- and 54-inch Satin Crepe and Flat Crepes, plain and novelty borders, fine quality, per yard.....	$3.75	$2.95
575 Yds.	Satin Crepe, Flat Crepe, Canton Crepe, etc., per yard.....	$3.50	$1.85
425 Yds.	39-inch Black Satin Charmeuse, supple quality. Special, per yard.....	$1.98	$1.45
1,000 Yds.	Japanese Pongee Silk, 33 inches wide, 12 momme. Special, per yard.....	79c	57c
2,300 Yds.	Lining Remnants—a vast accumulation of odds and ends, per yard.....	69c	25c
400 Yds.	50-inch All-Wool Chiffon Broadcloth—light and dark colors, per yard.....	$3.50	$2.48
350 Yds.	54-inch All-Wool Scotch Tweeds and border cloths, per yard.....	$3.00	$1.89
535 Yds.	27- to 30-inch All-Wool Dress Flannels, good colors, per yard.....	$1.50	89c
650 Yds.	72-inch Beacon Robe Flannel, pretty colors. Special, per yard.....	$2.00	$1.39

You are to ascertain: (a) the amount received for this merchandise, assuming that all of it was sold during the sale; and (b) how much more would have been received if the merchandise had been sold at the marked price?

41. The cost of operating a bus line between two cities during August was as follows: labor, $327.65; gasoline, $299.40; repairs, $22.50; depreciation, $250. The income from passenger fares during the period was $1,146.83. (a) Did the bus company lose or gain through their operations? (b) How much?

42. Samuel May paid $60 for four automobile tires. The speedometer reading when the new tires were put on was 8,641 miles, and when they were replaced with new ones, 23,641. What was the tire cost per hundred miles?

43. A grocer bought five bags of coffee weighing: 123 lbs., 132 lbs., 129 lbs., 127 lbs., 133 lbs., at 14c per pound, and sold it at 17c per pound. You are required to show: (a) the cost of the coffee; (b) the selling price of the coffee; and (c) the profit.

44. H. M. Clark purchased a farm containing 640 acres at $60 an acre. After paying $3,250 for improvements, he sold the farm for $45,382. You are to show (a) the cost of the farm plus the improvements, and (b) the profit.

45. Solve the following problems by cancellation:

a. $(9\times8\times6\times5\times4\times2)\div(8\times5\times4\times3\times2)=$

b. $(8\times8\times7\times6\times7\times2)\div(4\times4\times3\times2\times2)=$

c. $(7\times6\times6\times6\times3\times3)\div(7\times6\times3\times3\times3)=$

d. $(9\times9\times8\times8\times5\times5)\div(9\times8\times3\times3\times4)=$

e. $(9\times6\times6\times4\times3\times2)\div(9\times8\times3\times3\times2)=$

f. $(8\times7\times7\times6\times3\times2)\div(7\times7\times4\times3\times3)=$

g. $(6\times6\times3\times3\times393)\div(3\times3\times2\times131\times2)=$

h. $(8\times8\times6\times3\times257)\div(4\times4\times3\times257\times4)=$

i. $(5\times6\times5\times2\times151)\div(5\times5\times2\times151\times3)=$

j. $(7\times6\times6\times3\times363)\div(7\times3\times2\times121\times9)=$

k. $(8\times7\times4\times4\times494)\div(7\times2\times2\times247\times2)=$

l. $(9\times8\times8\times4\times756)\div(8\times3\times4\times189\times4)=$

46. The average yield of a field of wheat was 38 bushel per acre. What was the total yield if the field contained 48 acres?

47. What is the average weight per bushel of the following: 2 bu. potatoes (60 pounds); 3 bu. timothy seed, (45 pounds); 6 bu. wheat (60 pounds); 6 bu. oats (32 pounds); 3 bu. corn (56 pounds).

The weights given in parenthesis are the weights per bushel.

48. The Murphy Lumber Company sold the Hazen Construction Company the following bill of lumber: 125 pieces, 2″

x 4″ x 14′ at $42.50; 165 pieces, 2″ x 6″ x 16′ at $42.50; 150 pieces, 1″ x 10″ x 12′ at $41; 225 pieces, 1″ x 3″ x 12′ at $39.50; 145 pieces, 4″ x 4″ x 12′ at $41.50; 189 pieces, 3″ x 3″ x 10′ at $44; and 175 pieces, 3″ x 4″ x 14′ at $46.50. Ascertain the value of this lumber the price being per thousand board feet.

NOTE: A piece of lumber 2″ x 4″ x 14′ is 14 feet long, 2 inches thick, and 4 inches wide; (″) means inches, (′) means feet when placed after a number. The number of pieces multiplied by the length in feet, by the width in inches, by the thickness in inches, divided by 12 gives the number of board feet; a board foot is one inch or less thick, 12 inches wide and 12 inches long. Multiply the number of board feet by the price per thousand to ascertain the value. Cancellation can be used for ascertaining the value of the lumber. The product, if the price is expressed in dollars and cents, is dollars and cents, with the five figures at the right expressing the cents and fraction of a cent; if the price is expressed in dollars only, the three figures at the right are cents and fraction of a cent.

49. J. O. McKinsey leased an apartment on July 1 for three years from the following October 1, at a rental of $3,000 per year. Mr. McKinsey was allowed to occupy the apartment immediately, but was not required to pay rent until October 1, at which time he was to pay the October rent; the rent was to be paid in advance on the first of each month thereafter. What was his average monthly rental at the expiration of the lease?

50. The cash receipts of the Stanley Department store for the first week in March, were as follows: Monday, $883.40; Tuesday, $986.52; Wednesday, $1,087.63; Thursday, $988.43; Friday, $1,046.25; and Saturday, $742.51. What was the average daily sales?

CHAPTER VIII

COMMON FRACTIONS

A *fraction* is one or more of the equal parts of a unit. When it is desired to express a value which is less than a unit, it is necessary to show the number of equal parts into which the unit is divided, and the number of these parts that are expressed. Thus, if a unit is divided into four equal parts, and it is desired to express the value of three of these equal parts, the value will be expressed as three fourths.

There are two methods of indicating a fractional value with figures. When the number of equal parts into which the unit is divided is written below a line, and the number of parts expressed, above the line, the expression is known as a *common fraction;* another expression known as a decimal fraction is discussed in a subsequent chapter. The *denominator* of a common fraction is the number which indicates the equal number of parts into which the unit is divided, and the *numerator* is the number which indicates the number of parts expressed. The numerator of a fraction is written above a horizontal line, or at the left of an oblique line, and the denominator is written below the horizontal line or at the right of the oblique line. Thus, if it is desired to express the fraction "three fourths", it is written "$\frac{3}{4}$" or "¾"; 3 is the numerator, and 4 is the denominator.

When the denominator is larger than the numerator, the fraction is a *proper* fraction; when the numerator is equal to or greater than the denominator, it is an *improper* fraction. Thus, $\frac{3}{4}$, $\frac{5}{6}$, $\frac{9}{10}$, $\frac{7}{11}$, etc., are proper fractions, and $\frac{5}{5}$, $\frac{9}{4}$, $\frac{11}{7}$, $\frac{25}{15}$, etc., are improper fractions. The value of a proper fraction is *less* than a unit; the value of an improper fraction is equal to or *more* than a unit.

EXERCISE No. 69, WRITING FRACTIONS

The following problems provide oral practice in: (a) explaining the method of writing a fraction; and (b) stating whether it is a proper or improper fraction. You are to describe the

method of writing the fraction and state the reason for its being a proper or improper fraction.

1	2	3
a. Three fourths	*a*. Nine sevenths	*a*. Sixteen nineteenths
b. Nine eighths	*b*. Six sevenths	*b*. Fifteen fourteenths
c. Seven sixths	*c*. Eleven fourteenths	*c*. Six seventeenths
d. Five sixths	*d*. Twenty fifths	*d*. Fifteen twelfths
e. Three thirds	*e*. Nineteen twentieths	*e*. Ten tenths

EXERCISE No. 70, REDUCTION OF FRACTIONS

The numbers used to express a fraction are referred to as its *terms*. When the numerator and the denominator are prime to each other, the fraction is expressed in its lowest terms. Factors which are common to both the numerator and the denominator may be eliminated without changing the value of the fraction. Dividing both the numerator and the denominator of a fraction by the same number eliminates a factor common to both; this is referred to as reducing the fraction to *lower* terms; if the division process eliminates all the factors which are common to both the numerator and denominator, the fraction is reduced to its *lowest* terms. Multiplying both the numerator and the denominator of a fraction by the same number, changes the terms, but does not alter the value; this process is known as reducing the fraction to *higher* terms.

The fraction, $\frac{5}{6}$, is expressed in its lowest terms, because 5 and 6 are prime to each other. The fraction, $\frac{6}{12}$, is not expressed in its lowest terms, because 2 is a factor common to both the numerator and denominator; hence, to reduce it to its lowest terms, it will be necessary to divide by 2, changing the fraction to $\frac{3}{8}$. If it is desired to express the fraction, $\frac{5}{6}$, in twelfths, it is necessary to multiply both the numerator and denominator by 2, changing the fraction to $\frac{10}{12}$; the value of the fraction, $\frac{10}{12}$, is the same as the value of the fraction, $\frac{5}{6}$.

The following problems provide oral practice in the reduction of fractions.

1. Reduce to lowest terms: $\frac{6}{10}$, $\frac{7}{21}$, $\frac{5}{20}$, $\frac{27}{33}$, $\frac{10}{15}$, $\frac{15}{18}$, $\frac{20}{24}$, $\frac{18}{27}$.
2. Express each of the following fractions with a denominator of twelve: $\frac{1}{2}$, $\frac{2}{3}$, $\frac{3}{4}$, $\frac{5}{6}$.

3. Reduce to lowest terms: $\frac{9}{12}$, $\frac{14}{21}$, $\frac{5}{15}$, $\frac{6}{12}$, $\frac{27}{36}$, $\frac{12}{18}$, $\frac{8}{16}$, $\frac{9}{21}$.

4. Express each of the following with a denominator of thirty-six: $\frac{1}{2}$, $\frac{3}{4}$, $\frac{2}{3}$, $\frac{4}{9}$, $\frac{5}{12}$, $\frac{7}{18}$.

5. Reduce to lowest terms: $\frac{18}{20}$, $\frac{6}{18}$, $\frac{5}{25}$, $\frac{25}{30}$, $\frac{13}{26}$, $\frac{19}{28}$, $\frac{5}{20}$, $\frac{14}{28}$.

6. Express each of the following with a denominator of forty-eight: $\frac{1}{2}$, $\frac{2}{3}$, $\frac{1}{4}$, $\frac{5}{6}$, $\frac{3}{8}$, $\frac{11}{16}$, $\frac{7}{24}$.

7. Reduce to lowest terms: $\frac{24}{48}$, $\frac{36}{54}$, $\frac{17}{51}$, $\frac{63}{72}$, $\frac{27}{81}$, $\frac{60}{70}$.

8. $\frac{1}{2}$ = how many 4ths, 10ths, 6ths, 12ths, 8ths, 24ths, 16ths, 14ths, 20ths, 32ds, 26ths, 40ths, 72ds, 18ths, 22ds, 34ths, 30ths, 88ths, 56ths, 38ths, 76ths, 64ths?

9. $\frac{1}{3}$ = how many 9ths, 30ths, 6ths, 15ths, 21sts, 18ths, 45ths, 12ths, 27ths, 72ds, 51sts, 33ds, 42ds, 39ths, 54ths, 60ths, 36ths, 57ths, 48ths, 69ths, 75ths, 93ds?

10. $\frac{1}{4}$ = how many 8ths, 16ths, 24ths, 44ths, 12ths, 56ths, 64ths, 32ds, 40ths, 52ds, 84ths, 96ths, 76ths, 36ths, 48ths, 28ths, 60ths, 68ths, 80ths, 88ths, 92ds?

11. $\frac{1}{5}$ = how many 5ths, 30ths, 45ths, 20ths, 80ths, 65ths, 15ths, 35ths, 75ths, 90ths, 55ths, 70ths, 25ths, 50ths, 10ths, 60ths, 95ths, 125ths, 100ths, 110ths?

EXERCISE No. 71, CHANGING THE VALUE OF A FRACTION

The value of a fraction is increased (a) by multiplying the numerator by a number greater than one; (b) by dividing the denominator by a number greater than one. Thus, multiplying the numerator of the fraction $\frac{3}{4}$ by 2 gives the fraction $\frac{6}{4}$; dividing the denominator of the fraction $\frac{3}{4}$ by 2 gives $\frac{3}{2}$. The value of the fraction has been doubled in each case.

The value of a fraction is decreased (a) by dividing the numerator by a number greater than one; (b) by multiplying the de-

nominator by a number greater than one. Thus, dividing the numerator of the fraction $\frac{4}{5}$ by 2 gives $\frac{2}{5}$; multiplying the denominator of the fraction $\frac{4}{5}$ by 2 gives $\frac{4}{10}$. The value of the fraction has been reduced one half in each case.

The reason for this increase and decrease in value of fractions is because the denominator indicates the number of equal parts into which a unit is divided, and the numerator the number of these parts that are expressed. If the number of parts into which a fraction is divided is increased, the value of the fraction is decreased; and if the number of parts expressed are increased, the value of the fraction is increased.

The following problems provide oral practice in increasing or decreasing the value of a fraction by the multiplication or division of the numerator or denominator. You are required to state in each case the value of the fraction after multiplication or division, and whether it is greater or less.

1. Divide the numerator or multiply the denominator of each of the following fractions by 3: $\frac{3}{4}$, $\frac{6}{7}$, $\frac{12}{13}$, $\frac{18}{19}$, $\frac{24}{25}$, $\frac{30}{31}$.
2. Multiply the numerator or divide the denominator of each of the following fractions by 4: $\frac{1}{4}$, $\frac{3}{8}$, $\frac{7}{12}$, $\frac{11}{16}$, $\frac{19}{20}$, $\frac{23}{24}$.
3. Divide the numerator or multiply the denominator of each of the following fractions by 6: $\frac{6}{7}$, $\frac{12}{17}$, $\frac{18}{19}$, $\frac{24}{25}$, $\frac{30}{31}$, $\frac{36}{37}$.
4. Multiply the numerator or divide the denominator of each of the following fractions by 8: $\frac{3}{8}$, $\frac{5}{16}$, $\frac{7}{24}$, $\frac{5}{32}$, $\frac{9}{40}$, $\frac{11}{48}$.

EXERCISE No. 72, MIXED NUMBERS

A mixed number is one which expresses a value involving a whole number and a fraction. Thus, if the value is five and three fourths, it is expressed in figures as $5\frac{3}{4}$; the value of a mixed number may be represented by an improper fraction, as $\frac{23}{4}$.

The following problems provide written practice in expressing the value in figures in the form of a mixed number. You are to express the following values with figures.

1. Ninety-nine and seven sixteenths
2. Twelve and nine elevenths
3. Two hundred forty-five and four twenty-fifths
4. Ninety-one and three fourths
5. Seventy-six and five eighteenths

6. Fifty-four and four ninths
7. Sixteen and five eighths
8. Twenty-seven and five thirty-seconds
9. Thirty-six and four twenty-fifths
10. Forty-six and fifteen sixteenths

EXERCISE No. 73, MIXED NUMBERS

The following problems provide written practice in changing an improper fraction to a mixed number, and a mixed number to an improper fraction.

When it is desired to change a mixed number to an improper fraction, it is necessary to multiply the integer by the denominator of the fraction, and add the numerator to ascertain the numerator of the improper fraction; the denominator will be the same as the denominator in the fraction of the mixed number. When a value is expressed in the form of an improper fraction and it is desired to change it to a mixed number, it is necessary to divide the numerator of the improper fraction by the denominator to ascertain the integer; the fractional value in the mixed number will be the remainder expressed as the numerator of a fraction, with the denominator the same as that in the improper fraction.

The illustrations below show the calculations necessary to change the mixed number $37\frac{17}{18}$ to an improper fraction, and the improper fraction $\frac{683}{18}$ to a mixed number.

$37\frac{17}{18} = \frac{683}{18}$

18
296
37
666
17
683

Following instructions, 37 is multiplied by 18, and 17 is added to the product, producing a fraction with a numerator, 683, and the denominator, 18.

Following instructions for reversing the process, the numerator, 683, is divided by the denominator, 18; the quotient, 37, is the integer; the numerator of the fraction is 17, and the denominator, 18, which is the same denominator as that in the improper fraction.

$\frac{683}{18} = 683 \div 18 = 37\frac{17}{18}$

$37\frac{17}{18}$

18)683
54
143
126
17

Change to mixed numbers:

1. *a.* $\frac{465}{16}$ *b.* $\frac{641}{85}$ *c.* $\frac{523}{41}$ *d.* $\frac{625}{26}$ *e.* $\frac{330}{43}$ *f.* $\frac{448}{221}$
2. *a.* $\frac{234}{87}$ *b.* $\frac{563}{55}$ *c.* $\frac{479}{76}$ *d.* $\frac{809}{87}$ *e.* $\frac{688}{24}$ *f.* $\frac{222}{112}$
3. *a.* $\frac{125}{68}$ *b.* $\frac{827}{88}$ *c.* $\frac{734}{71}$ *d.* $\frac{426}{42}$ *e.* $\frac{522}{86}$ *f.* $\frac{643}{333}$
4. *a.* $\frac{654}{89}$ *b.* $\frac{236}{28}$ *c.* $\frac{128}{36}$ *d.* $\frac{689}{42}$ *e.* $\frac{956}{634}$ *f.* $\frac{996}{122}$

Change to improper fractions:

1	2	3	4	5	6
a. $66\frac{3}{5}$	*a.* $47\frac{2}{5}$	*a.* $88\frac{4}{5}$	*a.* $183\frac{4}{5}$	*a.* $476\frac{5}{12}$	*a.* $588\frac{15}{16}$
b. $47\frac{5}{8}$	*b.* $55\frac{4}{9}$	*b.* $91\frac{2}{3}$	*b.* $198\frac{6}{7}$	*b.* $684\frac{9}{11}$	*b.* $226\frac{9}{34}$
c. $86\frac{2}{5}$	*c.* $68\frac{3}{8}$	*c.* $72\frac{4}{7}$	*c.* $234\frac{7}{8}$	*c.* $782\frac{13}{15}$	*c.* $325\frac{23}{39}$
d. $27\frac{7}{9}$	*d.* $48\frac{3}{4}$	*d.* $89\frac{2}{9}$	*d.* $681\frac{2}{3}$	*d.* $575\frac{6}{11}$	*d.* $609\frac{48}{71}$
e. $48\frac{2}{3}$	*e.* $19\frac{1}{6}$	*e.* $16\frac{1}{8}$	*e.* $181\frac{1}{2}$	*e.* $431\frac{10}{11}$	*e.* $189\frac{1}{7}$
f. $13\frac{5}{6}$	*f.* $11\frac{5}{8}$	*f.* $17\frac{2}{3}$	*f.* $168\frac{1}{3}$	*f.* $134\frac{8}{9}$	*f.* $300\frac{1}{9}$
g. $24\frac{2}{7}$	*g.* $9\frac{10}{11}$	*g.* $81\frac{3}{8}$	*g.* $99\frac{9}{10}$	*g.* $101\frac{1}{10}$	*g.* $201\frac{1}{11}$

ADDITION OF COMMON FRACTIONS

As explained in Chapter II, the purpose of addition is to ascertain the sum of two or more numbers. This same purpose applies to the addition of fractions. The sum obtained from the addition of two or more fractions will be of greater value than any one of the fractions, just the same as the sum of two or more whole numbers is greater than any of the numbers.

Since a fraction is one or more of the equal parts of a unit, and the equal division of the units is indicated by the denominator and the value expressed by the numerator, it is quite evident that fractions cannot be added, unless the denominators are the same. When the denominators of two fractions are expressed by the same number, the process of addition is to add the numerators, and write this sum as the numerator over the same number as the denominator. Thus, $\frac{2}{6}+\frac{3}{6}=\frac{5}{6}$.

When the denominators of each of the fractions to be added are expressed by different numbers, it is necessary to reduce the fractions to a common denominator. Thus, if it is desired to add $\frac{5}{6}$ and $\frac{1}{3}$, the third may be changed to sixths by reducing the fraction to higher terms, as explained in Exercise No. 70. Following this process, three is contained in six two times; multiplying the numerator of one third by two changes the form of the fraction to $\frac{2}{6}$, hence the problem would be: $\frac{5}{6}+\frac{2}{6}=\frac{7}{6}=1\frac{1}{6}$.

Common fractions are used extensively in business, and in some lines such as dry goods, many problems require the addition of fractional values expressed in common fraction form. Usually in business problems, fractional values are expressed with small denominators; such as $\frac{1}{2}$, $\frac{1}{4}$, $\frac{3}{4}$, $\frac{1}{8}$, $\frac{1}{16}$, and sometimes $\frac{1}{32}$.

EXERCISE No. 74, ADDITION OF FRACTIONS

The following problems provide oral practice in adding fractions with a small denominator, when the denominators are the same, or can be made the same without written calculations.

The answer should be stated as a fraction if the value is less than one, or a mixed number with the fraction in its lowest terms, if the value is more than one.

1	2	3	4
a. $\frac{1}{5}+\frac{2}{5}=$	*a.* $\frac{2}{3}+\frac{3}{4}=$	*a.* $\frac{3}{5}+\frac{2}{5}+\frac{4}{5}=$	*a.* $\frac{1}{3}+\frac{1}{4}+\frac{1}{2}=$
b. $\frac{7}{10}+\frac{3}{10}=$	*b.* $\frac{3}{5}+\frac{7}{10}=$	*b.* $\frac{3}{7}+\frac{5}{7}+\frac{2}{7}=$	*b.* $\frac{4}{5}+\frac{1}{3}+\frac{3}{4}=$
c. $\frac{4}{5}+\frac{3}{5}=$	*c.* $\frac{4}{7}+\frac{3}{14}=$	*c.* $\frac{4}{9}+\frac{2}{9}+\frac{5}{9}=$	*c.* $\frac{2}{9}+\frac{3}{6}+\frac{1}{3}=$
d. $\frac{5}{11}+\frac{4}{11}=$	*d.* $\frac{5}{6}+\frac{1}{3}=$	*d.* $\frac{3}{10}+\frac{5}{10}+\frac{7}{10}=$	*d.* $\frac{3}{7}+\frac{5}{14}+\frac{2}{21}=$
e. $\frac{7}{12}+\frac{7}{12}=$	*e.* $\frac{4}{9}+\frac{5}{9}=$	*e.* $\frac{3}{14}+\frac{5}{14}+\frac{9}{14}=$	*e.* $\frac{7}{16}+\frac{3}{4}+\frac{3}{8}=$

EXERCISE No. 75, LEAST COMMON DENOMINATOR

When the denominators of the fractions to be added are expressed as large numbers, or there are a number of small denominators, thus making it inconvenient to determine the common denominator mentally, it is necessary to obtain the common denominators of the fractions by factoring as explained in Exercise No. 67. Although a common denominator is satisfactory, it is better to secure the least common denominator, and thus save time in reducing and adding the fractions.

The illustrations below show a solution of the problem: $\frac{5}{36}+\frac{7}{24}+\frac{17}{18}=1\frac{3}{8}$

a. 2)36—24—18
2)18—12— 9
3)9— 6— 9
3)3— 2— 3
1— 2— 1
$2\times2\times3\times3\times2=72$
l. c. m. $=72$

b. $\frac{5}{36}=72\div36=2\times5=10$
$\frac{7}{24}=72\div24=3\times7=21$
$\frac{17}{18}=72\div18=4\times17=68$

c. $\frac{10}{72}+\frac{21}{72}+\frac{68}{72}=\frac{99}{72}$

d. $\frac{99}{72}=1\frac{27}{72}=1\frac{3}{8}$

When factoring to secure the least common multiple and reduce the fractions to their least common denominator, it is necessary to (a) divide the denominators of the fractions by prime numbers which will exactly divide two or more of them. The l. c. m. which is to be the denominator of the fractions is obtained by multiplying together the divisors and remainders. The next process (b) is to find the value of each fraction in seventy-seconds. In (c) the values found in (b) are placed over the l. c. d., 72, and added. The sum (d) is an improper fraction which is reduced to a mixed number with the fraction in its lowest terms.

The following problems provide written practice in the addition of two or more fractions. Show on tablet paper: (a) the factoring necessary to secure the l. c. m.; (b) the calculations necessary to reduce each fraction so that its value may be expressed in that of the l. c. d.; (c) the process of addition and reduction of the sum to a fraction, or a mixed number with the fraction in its lowest terms.

1	2	3	4
a. $\frac{9}{14}+\frac{17}{28}=$	*a.* $\frac{11}{17}+\frac{8}{34}=$	*a.* $\frac{5}{28}+\frac{7}{16}+\frac{3}{14}=$	*a.* $\frac{5}{13}+\frac{3}{26}+\frac{7}{8}=$
b. $\frac{13}{15}+\frac{13}{20}=$	*b.* $\frac{5}{72}+\frac{53}{56}=$	*b.* $\frac{4}{15}+\frac{13}{25}+\frac{29}{30}=$	*b.* $\frac{3}{11}+\frac{8}{99}+\frac{7}{66}=$
c. $\frac{7}{24}+\frac{19}{36}=$	*c.* $\frac{31}{32}+\frac{49}{96}=$	*c.* $\frac{11}{12}+\frac{29}{32}+\frac{13}{16}=$	*c.* $\frac{13}{45}+\frac{23}{36}+\frac{13}{18}=$
d. $\frac{25}{36}+\frac{19}{48}=$	*d.* $\frac{43}{48}+\frac{35}{36}=$	*d.* $\frac{13}{30}+\frac{47}{54}+\frac{23}{27}=$	*d.* $\frac{25}{56}+\frac{13}{28}+\frac{7}{12}=$
e. $\frac{41}{50}+\frac{12}{25}=$	*e.* $\frac{19}{20}+\frac{7}{40}=$	*e.* $\frac{1}{10}+\frac{3}{20}+\frac{7}{30}=$	*e.* $\frac{4}{7}+\frac{3}{28}+\frac{2}{42}=$

EXERCISE No. 76, ADDITION OF FRACTIONS

The following problems provide written practice in adding a number of fractions.

1	2	3
a. $\frac{1}{6}+\frac{2}{3}+\frac{3}{4}+\frac{1}{2}=$	*a.* $\frac{2}{5}+\frac{3}{10}+\frac{7}{10}+\frac{3}{5}=$	*a.* $\frac{5}{24}+\frac{3}{8}+\frac{5}{16}+\frac{8}{9}=$
b. $\frac{3}{5}+\frac{1}{10}+\frac{1}{2}+\frac{5}{6}=$	*b.* $\frac{1}{8}+\frac{3}{4}+\frac{1}{2}+\frac{7}{8}=$	*b.* $\frac{3}{20}+\frac{3}{5}+\frac{5}{10}+\frac{2}{15}=$
c. $\frac{2}{3}+\frac{5}{8}+\frac{7}{12}+\frac{1}{6}=$	*c.* $\frac{2}{3}+\frac{5}{6}+\frac{1}{2}+\frac{1}{3}=$	*c.* $\frac{3}{72}+\frac{9}{24}+\frac{7}{8}+\frac{5}{12}=$
d. $\frac{5}{7}+\frac{2}{3}+\frac{7}{9}+\frac{1}{3}=$	*d.* $\frac{1}{4}+\frac{7}{12}+\frac{2}{3}+\frac{2}{6}=$	*d.* $\frac{24}{80}+\frac{2}{5}+\frac{7}{16}+\frac{1}{8}=$
e. $\frac{1}{9}+\frac{3}{7}+\frac{2}{3}+\frac{6}{7}=$	*e.* $\frac{2}{3}+\frac{4}{9}+\frac{1}{18}+\frac{5}{6}=$	*e.* $\frac{32}{65}+\frac{3}{13}+\frac{4}{5}+\frac{9}{10}=$
f. $\frac{1}{6}+\frac{1}{8}+\frac{1}{3}+\frac{1}{4}=$	*f.* $\frac{2}{9}+\frac{3}{7}+\frac{1}{18}+\frac{1}{14}=$	*f.* $\frac{22}{31}+\frac{1}{62}+\frac{1}{4}+\frac{1}{12}=$

EXERCISE No. 77, ADDITION OF MIXED NUMBERS

When a problem requires the addition of mixed numbers, the process is the same as the addition of whole numbers, and the addition of fractions. The illustration below shows the process of adding $49\frac{2}{3}$ and $16\frac{2}{3}$.

$$\begin{array}{r} 49\frac{2}{3} \\ 16\frac{2}{3} \\ \hline 66\frac{1}{3} \end{array}$$

Add the fractions first, $\frac{2}{3}+\frac{2}{3}=\frac{4}{3}=1\frac{1}{3}$. Place the $\frac{1}{3}$ and carry the 1. Add the unit column of the whole numbers, $1+6+9=16$. Place the 6 and carry the 1. Add the tens column, $1+1+4=6$, which is placed under the tens column, making the sum of the two mixed numbers $66\frac{1}{3}$.

The following problems provide oral practice in the addition of mixed numbers

1. $3\frac{1}{2}+18\frac{1}{2}=$
2. $16\frac{2}{3}+24\frac{1}{3}=$
3. $37\frac{1}{8}+12\frac{1}{4}=$
4. $775\frac{1}{5}+18\frac{2}{5}=$
5. $19\frac{3}{4}+17\frac{1}{8}=$
6. $64\frac{1}{7}+46\frac{5}{7}=$
7. $49\frac{2}{3}+16\frac{2}{3}=$
8. $19\frac{3}{8}+27\frac{7}{8}=$
9. $14\frac{6}{7}+21\frac{5}{7}=$
10. $78\frac{5}{9}+12\frac{2}{3}=$
11. $35\frac{5}{6}+33\frac{1}{3}=$
12. $17\frac{1}{5}+18\frac{3}{10}=$
13. $37\frac{5}{8}+19\frac{1}{4}=$
14. $17\frac{1}{2}+45\frac{3}{4}=$
15. $18\frac{1}{6}+14\frac{2}{3}=$
16. $22\frac{3}{8}+19\frac{3}{4}=$
17. $19\frac{3}{10}+75\frac{4}{5}=$
18. $77\frac{3}{7}+15\frac{9}{14}=$
19. $78\frac{1}{10}+12\frac{1}{5}=$
20. $68\frac{7}{10}+11\frac{9}{10}=$
21. $45\frac{5}{6}+13\frac{5}{12}=$
22. $43\frac{14}{15}+17\frac{4}{5}=$
23. $58\frac{5}{12}+16\frac{5}{6}=$
24. $39\frac{3}{8}+15\frac{1}{6}=$
25. $27\frac{5}{6}+17\frac{2}{3}=$
26. $15\frac{1}{2}+15\frac{2}{3}=$
27. $71\frac{1}{9}+12\frac{5}{6}=$
28. $45\frac{2}{3}+11\frac{1}{4}=$
29. $39\frac{4}{7}+93\frac{5}{7}=$
30. $75\frac{1}{8}+45\frac{3}{4}=$

EXERCISE No. 78, ADDITION OF MIXED NUMBERS

The following problems provide written practice in the addition of mixed numbers.

1. $192\frac{3}{4}+17\frac{5}{6}=$
2. $187\frac{1}{6}+96\frac{2}{3}=$
3. $98\frac{3}{5}+85\frac{3}{8}=$
4. $126\frac{6}{7}+74\frac{3}{5}=$
5. $79\frac{6}{11}+81\frac{15}{22}=$
6. $96\frac{1}{4}+77\frac{9}{20}=$
7. $73\frac{1}{45}+106\frac{8}{9}=$
8. $915\frac{6}{7}+94\frac{1}{15}=$
9. $726\frac{11}{12}+86\frac{4}{5}=$
10. $123\frac{7}{8}+49\frac{6}{7}=$
11. $215\frac{9}{54}+67\frac{33}{40}=$
12. $945\frac{35}{48}+212\frac{3}{16}=$
13. $712\frac{17}{25}+127\frac{27}{36}=$
14. $214\frac{9}{32}+69\frac{3}{8}=$
15. $163\frac{18}{31}+724\frac{2}{3}=$
16. $147\frac{3}{10}+127\frac{2}{7}=$
17. $193\frac{14}{15}+67\frac{16}{25}=$
18. $98\frac{19}{28}+77\frac{31}{35}=$
19. $714\frac{4}{19}+69\frac{1}{2}=$
20. $215\frac{9}{18}+75\frac{3}{4}=$
21. $89\frac{7}{8}+45\frac{12}{15}=$
22. $215\frac{11}{12}+230\frac{15}{16}=$
23. $318\frac{9}{10}+64\frac{7}{8}=$
24. $64\frac{29}{30}+86\frac{23}{48}=$
25. $86\frac{14}{25}+76\frac{35}{45}=$
26. $126\frac{27}{62}+815\frac{62}{124}=$
27. $137\frac{5}{6}+78\frac{6}{7}=$
28. $194\frac{15}{21}+183\frac{6}{7}=$
29. $186\frac{15}{16}+75\frac{9}{108}=$
30. $87\frac{3}{54}+67\frac{7}{45}=$
31. $128\frac{11}{77}+76\frac{11}{63}=$
32. $126\frac{9}{12}+47\frac{7}{18}=$
33. $195\frac{8}{10}+726\frac{5}{11}=$
34. $624\frac{9}{24}+115\frac{15}{72}=$
35. $312\frac{3}{32}+65\frac{13}{28}=$
36. $163\frac{8}{11}+83\frac{3}{10}=$
37. $134\frac{24}{33}+526\frac{45}{63}=$
38. $915\frac{16}{21}+49\frac{75}{105}=$
39. $715\frac{65}{72}+146\frac{7}{12}=$

SUBTRACTION OF COMMON FRACTIONS

As explained in Chapter III, the purpose of subtraction is to ascertain the difference between two numbers. This same purpose applies to the subtraction of fractions. The subtraction of fractions involves: (a) the subtraction of one common fraction

from another; (b) the subtraction of a fraction from a whole number; (c) the subtraction of a fraction from a mixed number; (d) and the subtraction of one mixed number from another. The process requires the denominators of the fractions to be the same, and one numerator is subtracted from the other.

EXERCISE No. 79, SUBTRACTION OF COMMON FRACTIONS

The following problems provide oral practice in subtracting fractions, when the denominators are the same, or the denominators are such that the least common denominator may be determined by observation. Accuracy and speed in solving problems involving fractions are just as important as in solving problems involving whole numbers.

1	2	3	4
a. $\frac{7}{8}-\frac{2}{8}$	*a.* $\frac{7}{9}-\frac{3}{5}$	*a.* $\frac{5}{6}-\frac{1}{6}$	*a.* $\frac{4}{5}-\frac{1}{10}$
b. $\frac{3}{4}-\frac{1}{4}$	*b.* $\frac{4}{7}-\frac{1}{6}$	*b.* $\frac{5}{8}-\frac{1}{6}$	*b.* $\frac{7}{9}-\frac{4}{18}$
c. $\frac{5}{6}-\frac{3}{6}$	*c.* $\frac{8}{9}-\frac{3}{4}$	*c.* $\frac{3}{4}-\frac{2}{7}$	*c.* $\frac{2}{3}-\frac{1}{10}$
d. $\frac{2}{3}-\frac{1}{3}$	*d.* $\frac{2}{5}-\frac{2}{7}$	*d.* $\frac{7}{8}-\frac{1}{2}$	*d.* $\frac{6}{7}-\frac{3}{14}$
e. $\frac{4}{9}-\frac{2}{9}$	*e.* $\frac{11}{27}-\frac{1}{9}$	*e.* $\frac{5}{6}-\frac{1}{3}$	*e.* $\frac{5}{6}-\frac{5}{12}$
f. $\frac{2}{3}-\frac{1}{4}$	*f.* $\frac{13}{15}-\frac{3}{5}$	*f.* $\frac{3}{4}-\frac{1}{2}$	*f.* $\frac{4}{5}-\frac{3}{10}$
g. $\frac{7}{12}-\frac{1}{6}$	*g.* $\frac{5}{6}-\frac{2}{9}$	*g.* $\frac{5}{8}-\frac{1}{2}$	*g.* $\frac{1}{2}-\frac{2}{9}$
h. $\frac{4}{15}-\frac{1}{5}$	*h.* $\frac{8}{15}-\frac{1}{3}$	*h.* $\frac{3}{4}-\frac{1}{5}$	*h.* $\frac{2}{3}-\frac{1}{6}$

EXERCISE No. 80, SUBTRACTION OF COMMON FRACTIONS

When the denominators are not the same, and a common denominator cannot be ascertained mentally, it is necessary to factor the same as in addition.

The following problems provide written practice in subtracting one fraction from another. Show on tablet paper all your calculations necessary to find the difference in each problem.

1	2	3	4
a. $\frac{11}{15}-\frac{3}{5}$	*a.* $\frac{25}{56}-\frac{2}{7}$	*a.* $\frac{14}{25}-\frac{3}{75}$	*a.* $\frac{14}{39}-\frac{8}{13}$
b. $\frac{10}{11}-\frac{3}{22}$	*b.* $\frac{23}{28}-\frac{5}{14}$	*b.* $\frac{27}{32}-\frac{5}{64}$	*b.* $\frac{13}{15}-\frac{13}{21}$
c. $\frac{11}{12}-\frac{7}{60}$	*c.* $\frac{37}{42}-\frac{5}{18}$	*c.* $\frac{8}{27}-\frac{5}{54}$	*c.* $\frac{17}{28}-\frac{13}{42}$
d. $\frac{22}{27}-\frac{2}{9}$	*d.* $\frac{7}{16}-\frac{3}{64}$	*d.* $\frac{9}{10}-\frac{11}{15}$	*d.* $\frac{21}{64}-\frac{13}{56}$
e. $\frac{13}{15}-\frac{8}{45}$	*e.* $\frac{16}{36}-\frac{1}{9}$	*e.* $\frac{17}{24}-\frac{5}{18}$	*e.* $\frac{18}{24}-\frac{11}{26}$
f. $\frac{27}{32}-\frac{13}{24}$	*f.* $\frac{49}{72}-\frac{3}{8}$	*f.* $\frac{7}{18}-\frac{5}{36}$	*f.* $\frac{32}{36}-\frac{13}{48}$

EXERCISE No. 81, A FRACTION FROM A WHOLE NUMBER

When it is desired to subtract a fraction from a whole number, the difference will be expressed as a fraction if the value of the whole number is one, or as a mixed number if the value is more than one.

The following problems provide oral practice in subtracting a fraction from a whole number.

1	2	3	4
a. $1-\frac{1}{2}$	*a.* $5-\frac{5}{9}$	*a.* $7-\frac{7}{11}$	*a.* $16-\frac{2}{3}$
b. $3-\frac{3}{4}$	*b.* $6-\frac{7}{8}$	*b.* $8-\frac{8}{13}$	*b.* $4-\frac{3}{4}$
c. $4-\frac{5}{8}$	*c.* $5-\frac{4}{5}$	*c.* $16-\frac{7}{16}$	*c.* $2-\frac{2}{3}$
d. $1-\frac{7}{8}$	*d.* $1-\frac{1}{3}$	*d.* $18-\frac{11}{18}$	*d.* $1-\frac{9}{10}$
e. $2-\frac{3}{7}$	*e.* $2-\frac{5}{6}$	*e.* $12-\frac{7}{12}$	*e.* $15-\frac{4}{5}$
f. $3-\frac{2}{3}$	*f.* $8-\frac{2}{5}$	*f.* $15-\frac{3}{4}$	*f.* $18-\frac{1}{6}$

EXERCISE No. 82, A MIXED NUMBER FROM A WHOLE NUMBER

When it is desired to subtract a mixed number from a whole number, or a whole number from a mixed number, the fractional value should be subtracted first, and then the whole number. The illustration at the left shows the process of subtracting 55 from $77\frac{4}{5}$, and the one at the right the process of subtracting $37\frac{5}{16}$ from 88.

$$\begin{array}{r} 77\frac{4}{5} \\ 55 \\ \hline 22\frac{4}{5} \end{array} \qquad \begin{array}{r} 88 \\ 37\frac{5}{16} \\ \hline 50\frac{11}{16} \end{array}$$

In the illustration at the left the fraction $\frac{4}{5}$ is brought down, because there is nothing to subtract from it. The whole numbers are then subtracted in the usual way.

In the illustration at the right, one whole number, $\frac{16}{16}$, is borrowed from 88 in order to subtract $\frac{5}{16}$ from it. This leaves a remainder of $\frac{11}{16}$. 88 is now 87, because 1 has been borrowed. $87-37=50$.

The following problems provide written practice in subtracting a mixed number from a whole number, and a whole number from a mixed number.

1	2	3	4
a. $49-32\frac{3}{16}$	*a.* $27\frac{5}{16}-19$	*a.* $39-27\frac{5}{16}$	*a.* $95\frac{16}{35}-77$
b. $97-38\frac{2}{25}$	*b.* $92\frac{23}{25}-63$	*b.* $42-33\frac{17}{56}$	*b.* $79\frac{27}{40}-36$
c. $55-27\frac{17}{19}$	*c.* $52\frac{11}{23}-27$	*c.* $86-57\frac{19}{43}$	*c.* $85\frac{45}{73}-67$
d. $63-32\frac{23}{35}$	*d.* $49\frac{16}{31}-41$	*d.* $74-35\frac{27}{50}$	*d.* $68\frac{37}{82}-35$

EXERCISE No. 83 A MIXED NUMBER FROM A MIXED NUMBER

When a problem requires the subtraction of one mixed number from another, the process is the same as when one of the numbers involved is an integer; that is, the fraction is subtracted first, and then the whole number. When the fraction in the minuend is of less value than the fraction in the subtrahend, it is necessary to borrow before subtracting.

$47\frac{7}{16}$
$25\frac{3}{16}$
$22\frac{4}{16} = 22\frac{1}{4}$

The illustration at the left shows the solution of $47\frac{7}{16} - 25\frac{3}{16}$. Since $\frac{3}{16}$ is smaller than $\frac{7}{16}$, it is not necessary to borrow.

$37\frac{1}{6} = \frac{2}{12} = \frac{14}{12}$
$21\frac{3}{4} = \frac{9}{12} = \frac{9}{12}$
$15 \quad \frac{5}{12}$

The illustration at the right shows the solution of $37\frac{1}{6} - 21\frac{3}{4}$. Since $\frac{1}{6}$ is smaller than $\frac{3}{4}$, it is necessary to borrow 1, or $\frac{12}{12}$, making the difference between the fractions, $\frac{5}{12}$; 21 subtracted from 36 leaves 15.

The following problems provide written practice in the subtraction of mixed numbers. Show on tablet paper all calculations necessary in solving these problems.

1	2	3
a. $18\frac{5}{12} - 16\frac{3}{5} =$	*a.* $197\frac{1}{4} - 88\frac{11}{12} =$	*a.* $712\frac{11}{16} - 639\frac{3}{40} =$
b. $92\frac{11}{18} - 36\frac{4}{5} =$	*b.* $279\frac{5}{7} - 93\frac{3}{14} =$	*b.* $212\frac{1}{15} - 138\frac{6}{45} =$
c. $71\frac{11}{15} - 47\frac{3}{7} =$	*c.* $261\frac{7}{8} - 39\frac{7}{12} =$	*c.* $176\frac{3}{32} - 132\frac{7}{96} =$
d. $18\frac{2}{17} - 13\frac{1}{5} =$	*d.* $198\frac{6}{7} - 96\frac{3}{18} =$	*d.* $169\frac{7}{11} - 142\frac{8}{22} =$

EXERCISE No. 84, ORAL PROBLEMS

1. A merchant bought a piece of cloth containing $30\frac{1}{2}$ yards, from which he has cut two pieces of $8\frac{3}{4}$ and $12\frac{1}{2}$ yards. How many yards remained?

2. From the number 34 continue to subtract $4\frac{1}{4}$ until nothing remains.

3. You buy $14\frac{1}{2}$ yards of cloth and make two dresses from the same pattern. If you have $\frac{3}{4}$ yard left and allow $\frac{1}{2}$ yard for waste, how many yards in each dress?

4. Add 6 to each term of $\frac{2}{3}$ and state how much the fraction is increased or decreased.

5. Add 2 to the numerator of the fraction $\frac{3}{9}$ and subtract 3 from the denominator; show the effect in fractional form by subtraction.

6. A clerk sold $6\frac{1}{2}$ yards of cloth from a piece containing $20\frac{1}{4}$ yds. How many yards remained?

CHAPTER IX

COMMON FRACTIONS (Continued)

MULTIPLICATION OF COMMON FRACTIONS

The multiplication of common fractions involves: (a) the multiplication of one fraction by another; (b) the multiplication of an integer by a fraction, or a fraction by an integer; (c) the multiplication of two mixed numbers; and (d) the multiplication of a mixed number by an integer or an integer by a mixed number. Multiplication of fractions is indicated by (a) the multiplication sign, "×", or (b) by the word, "of", between the two fractions to be multiplied.

$\frac{3}{4}\times\frac{5}{6}$, indicates that it is desired to ascertain the product of the two fractions. $\frac{5}{6}$ of $\frac{3}{4}$, indicates that it is desired to ascertain the product of these two fractions. The product is the same with either form of expression.

EXERCISE No. 85, MULTIPLICATION OF FRACTIONS

The following problems provide oral practice in multiplying one fraction by another. The product is obtained by multiplying the numerators together to form the numerator of the product, and multiplying the denominators together to form the denominator of the product. When the numerator and denominator in the product are not prime to each other, express in lowest terms.

1	2	3	4	5
a. $\frac{2}{3}\times\frac{3}{4}$	*a.* $\frac{3}{5}$ of $\frac{2}{3}$	*a.* $\frac{4}{9}\times\frac{5}{6}$	*a.* $\frac{1}{2}$ of $\frac{7}{9}$	*a.* $\frac{3}{4}$ of $\frac{3}{5}$
b. $\frac{3}{8}\times\frac{3}{4}$	*b.* $\frac{3}{4}$ of $\frac{2}{3}$	*b.* $\frac{2}{5}\times\frac{5}{6}$	*b.* $\frac{2}{5}$ of $\frac{3}{7}$	*b.* $\frac{4}{7}$ of $\frac{3}{7}$
c. $\frac{1}{3}\times\frac{3}{8}$	*c.* $\frac{2}{7}$ of $\frac{1}{3}$	*c.* $\frac{3}{5}\times\frac{5}{6}$	*c.* $\frac{3}{5}$ of $\frac{2}{3}$	*c.* $\frac{5}{8}$ of $\frac{2}{4}$
d. $\frac{2}{3}\times\frac{1}{2}$	*d.* $\frac{4}{5}$ of $\frac{2}{3}$	*d.* $\frac{3}{5}\times\frac{5}{9}$	*d.* $\frac{1}{2}$ of $\frac{1}{8}$	*d.* $\frac{7}{8}$ of $\frac{3}{4}$
e. $\frac{5}{8}\times\frac{2}{3}$	*e.* $\frac{1}{5}$ of $\frac{3}{4}$	*e.* $\frac{1}{2}\times\frac{1}{2}$	*e.* $\frac{5}{6}$ of $\frac{1}{2}$	*e.* $\frac{5}{6}$ of $\frac{7}{8}$

EXERCISE No. 86, MULTIPLICATION OF FRACTIONS

The following problems provide written practice in the multiplication of fractions. You are to show on tablet paper: (a) the multiplication process to ascertain the numerator; (b) the multi-

plication process to ascertain the denominator; and (c) the reduction process necessary to express the fraction in its lowest terms.

$\frac{11}{36}\times\frac{9}{16}=\frac{99}{576}$
$\frac{99}{576}\div\frac{9}{9}=\frac{11}{64}$

The illustration at the left shows the solution of $\frac{11}{36}\times\frac{9}{16}$. The product of the numerators (99) is placed over the product of the denominators (576). Since 99 and 576 are not prime to each other, the fraction is reduced to its lowest terms, $\frac{11}{64}$.

1	2	3	4	5
a. $\frac{16}{35}\times\frac{13}{22}$	*a.* $\frac{12}{41}$ of $\frac{15}{56}$	*a.* $\frac{72}{91}\times\frac{53}{64}$	*a.* $\frac{34}{49}$ of $\frac{28}{39}$	*a.* $\frac{45}{84}\times\frac{72}{93}$
b. $\frac{9}{40}\times\frac{21}{32}$	*b.* $\frac{27}{35}$ of $\frac{24}{31}$	*b.* $\frac{48}{53}\times\frac{23}{26}$	*b.* $\frac{36}{85}$ of $\frac{34}{45}$	*b.* $\frac{39}{62}\times\frac{42}{53}$
c. $\frac{15}{42}\times\frac{27}{35}$	*c.* $\frac{24}{29}$ of $\frac{37}{38}$	*c.* $\frac{45}{64}\times\frac{56}{63}$	*c.* $\frac{37}{48}$ of $\frac{72}{83}$	*c.* $\frac{35}{86}\times\frac{27}{43}$
d. $\frac{29}{42}\times\frac{7}{36}$	*d.* $\frac{18}{65}$ of $\frac{26}{27}$	*d.* $\frac{72}{83}\times\frac{45}{64}$	*d.* $\frac{56}{63}$ of $\frac{36}{49}$	*d.* $\frac{48}{53}\times\frac{57}{64}$
e. $\frac{24}{45}\times\frac{17}{22}$	*e.* $\frac{25}{44}$ of $\frac{48}{55}$	*e.* $\frac{27}{35}\times\frac{31}{50}$	*e.* $\frac{27}{56}$ of $\frac{64}{81}$	*e.* $\frac{63}{64}\times\frac{65}{72}$

EXERCISE No. 87, MULTIPLICATION BY CANCELLATION

When two or more fractions are to be multiplied together and there are factors common to the numerators and denominators, cancellation may be used before multiplying, thus reducing the calculations necessary to obtain the product. The cancellation process is as follows:

$$\frac{5}{6}\text{ of }\frac{12}{35}\text{ of }\frac{7}{9}=\frac{\cancel{5}}{\cancel{6}}\times\frac{\overset{2}{\cancel{12}}}{\cancel{35}}\times\frac{\cancel{7}}{\cancel{9}}=\frac{2}{9}.$$

1	2	3
a. $\frac{5}{8}$ of $\frac{12}{25}$	*a.* $\frac{1}{2}\times\frac{4}{9}\times\frac{3}{4}$	*a.* $\frac{16}{35}\times\frac{27}{36}\times\frac{25}{32}\times\frac{18}{36}$
b. $\frac{3}{4}$ of $\frac{12}{15}$	*b.* $\frac{7}{8}\times\frac{2}{3}\times\frac{5}{7}$	*b.* $\frac{45}{56}\times\frac{35}{54}\times\frac{39}{64}\times\frac{24}{25}$
c. $\frac{3}{4}$ of 16	*c.* $\frac{5}{8}\times\frac{4}{5}\times\frac{5}{7}$	*c.* $\frac{27}{50}\times\frac{20}{63}\times 48\times\frac{35}{24}$
d. $\frac{5}{8}$ of 24	*d.* $\frac{8}{9}\times\frac{5}{8}\times\frac{3}{5}$	*d.* $36\times\frac{19}{24}\times\frac{15}{38}\times\frac{16}{45}$

EXERCISE No. 88, MULTIPLICATION OF MIXED NUMBERS

When a fraction is involved in either the multiplier or multiplicand, it is best to multiply by the fraction first, and then by the whole numbers. The method is illustrated below.

468	The solution at the left shows the process of multiplying a whole number by a mixed number. $\frac{3}{4}$ of 468 is 351. This amount is written as the first partial product in the solution. The whole numbers are then multiplied in the usual manner.	$385\frac{2}{5}$
$44\frac{3}{4}$		65
351		26
1872		1925
1872	The solution at the right shows the process of multiplying a mixed number by a whole number. $\frac{2}{5}$ of 65 is 26. This amount is written as the first partial product in the solution. The whole numbers are then multiplied in the usual manner.	2310
20943		25051

The following problems provide written practice in multiplication of mixed numbers when a fraction is in either the multiplier or multiplicand. Solve each problem on tablet paper as illustrated, and prove the product by reverse multiplication.

1. $145\frac{1}{5}\times85$
2. $318\frac{1}{3}\times99$
3. $423\frac{1}{2}\times74$
4. $438\frac{5}{6}\times36$
5. $523\frac{1}{8}\times48$
6. $623\times55\frac{3}{7}$
7. $560\times25\frac{3}{8}$
8. $728\times57\frac{7}{8}$
9. $372\times45\frac{3}{4}$
10. $256\times88\frac{5}{8}$
11. $784\times16\frac{3}{4}$
12. $272\times27\frac{1}{8}$
13. $565\times32\frac{3}{5}$
14. $459\times27\frac{4}{9}$
15. $875\times42\frac{5}{6}$
16. 19 gallons of gasoline at $22\frac{1}{2}$c per gallon
17. 85 yards of gingham at $36\frac{3}{4}$c per yard
18. 506 pounds of sugar at $9\frac{1}{2}$c per pound
19. $58\frac{1}{2}$ pounds of rice at 12c per pound
20. 56 pounds of coffee at $47\frac{1}{2}$c per pound

EXERCISE No. 89, MULTIPLICATION OF MIXED NUMBERS

When both the multiplier and the multiplicand are mixed numbers, there are two methods of solution: (a) multiply the fractions first, and then multiply the whole numbers; (b) change the mixed numbers to improper fractions, multiply, and reduce. The illustrations below show both methods applied to the problem, $228\frac{1}{2}\times36\frac{2}{3}$.

$228\frac{1}{2}$
$36\frac{2}{3}$

$\frac{1}{3}$
152
18
1368
684

$8378\frac{1}{3}$

The solution at the left shows the multiplication without changing to an improper fraction. The product of the two fractions is $\frac{1}{3}$; the product of $228\times\frac{2}{3}$ is 152; the product of $36\times\frac{1}{2}$ is 18; the product of 228×6 is 1,368; the product of 228×3 is 684. The sum of the 5 partial products is $8,378\frac{1}{3}$.

$228\frac{1}{2}=\frac{457}{2}$, $\quad 36\frac{2}{3}=\frac{110}{3}$

$\frac{457}{2}\times\frac{110}{3}=\frac{25135}{3}=8,378\frac{1}{3}$

The solution at the right shows the multiplication after changing to improper fractions. The multiplicand is equivalent to the fraction, $\frac{457}{2}$, and the multiplier, the fraction, $\frac{110}{3}$. The product of these two fractions will give the desired answer. In this case the 2 and 110 have a factor which is common, hence cancellation is employed before multiplication.

It is suggested that you use the method at the left when the denominator of the fraction in the multiplier is exactly contained in the whole number of the multiplicand, and the denominator of the fraction in the multiplicand is exactly contained in the whole number of the multiplier. When the above is not the case, the solution at the right should be used.

The following problems provide written practice in multiplying mixed numbers. Show your results on tablet paper in the same form as the illustrations, and prove by reverse multiplication.

1. $368\frac{2}{7} \times 42\frac{5}{8}$
2. $425\frac{1}{7} \times 27\frac{2}{5}$
3. $436\frac{1}{6} \times 25\frac{3}{5}$
4. $336\frac{3}{8} \times 48\frac{3}{4}$
5. $880\frac{5}{6} \times 48\frac{1}{4}$
6. $785\frac{7}{9} \times 235\frac{3}{8}$
7. $496\frac{1}{5} \times 312\frac{2}{5}$
8. $425\frac{2}{5} \times 345\frac{3}{5}$
9. $878\frac{4}{9} \times 256\frac{3}{7}$
10. $327\frac{1}{2} \times 124\frac{2}{3}$
11. $348\frac{2}{3} \times 27\frac{5}{8}$
12. $573\frac{2}{5} \times 45\frac{1}{9}$
13. $549\frac{5}{6} \times 72\frac{4}{9}$
14. $785\frac{4}{7} \times 35\frac{3}{8}$
15. $924\frac{2}{3} \times 46\frac{2}{9}$
16. $384\frac{1}{4}$ yards of cotton sheeting at $68\frac{1}{2}$c per yard*
17. $246\frac{1}{4}$ yards of tissue gingham at $24\frac{1}{2}$c per yard
18. $35\frac{1}{2}$ tons of coal at \$5.62$\frac{1}{2}$ per ton
19. $128\frac{1}{4}$ pounds of sugar at $7\frac{1}{3}$c per pound
20. $56\frac{1}{2}$ pounds of lard at $11\frac{1}{3}$c per pound

EXERCISE No. 90, WRITTEN PROBLEMS

(Problems with unnecessary facts given)

1. If a tank $12\frac{1}{2}$ feet wide and $16\frac{1}{8}$ feet long contains $820\frac{1}{3}$ gallons when $\frac{2}{3}$ full, how many gallons will it hold when full?

2. A cube is $7\frac{1}{3}$ inches each way and weighs $125\frac{2}{3}$ lbs. What will it cost to put a brass edging on all edges at $4\frac{1}{2}$c a foot, and a brass ball on each corner at $7\frac{1}{2}$c each?

3. A square garden $4\frac{1}{3}$ rods each way and a square garden $8\frac{2}{3}$ rods each way were planted to cabbage. The first produced 2,610 lbs. of cabbage; the second 4,350 lbs. The cabbage was sold at $3\frac{1}{3}$c a lb. The cabbage produced on the first garden is what fractional part of that produced on the second?

4. J. L. Simpson, a farmer, sold 138 watermelons weighing 2,055 pounds. He sold one half of the melons at three for a dollar, and the remainder at 25c each. How much did he receive?

5. T. C. Moore sold 125 sacks of wheat containing two and one fourth bushels per sack. He received \$2.37$\frac{1}{2}$ per sack for 54 sacks and \$2.12$\frac{1}{2}$ per sack for the remainder. How much did he receive for the wheat?

*NOTE. It is the custom in business, when solving problems involving dollars and cents to drop the fraction in the result if less than one half cent, and to call the fraction an extra cent if one half or more. You should follow this method unless otherwise instructed.

EXERCISE No. 91, BILLING

Fractions are used frequently in business in marking the extensions of invoices and inventories. It is not always possible to have the unit value of the merchandise expressed as a whole number, and market conditions often make it necessary to use fractions in the prices.

The following problems provide written practice in making extensions and ascertaining the total of an invoice, when common fractions are involved in the quantity, price, or both.

1. The Creasey Wholesale Grocery Company sold the T. F. Cook Company the following merchandise on April 1:

50 bbls. sugar (15,539½ lbs.)	@	8½c per lb.
1 bbl. molasses (51¼ gals.)	@	64½c per gal.
102 lbs. cheese	@	29½c per lb.
15 doz. lemons	@	36½c per doz.
8½ bags of potatoes	@	$1.95 per bag
28½ lbs. lard	@	28¼c per lb.
10½ doz. cans asparagus	@	$2.80 per doz.
12 doz. bars Grandma's soap	@	61¼c per doz.

2. Ascertain the value of the following sales made by the Fair Store, May 18, to Ronald Smith:

29½ yards of fancy outing flannel	@	19⅓c per yard
14½ yards dress gingham	@	18¾c " "
27¾ yards of windsor crepe	@	22⅕c " "
35¼ yards of challie	@	16½c " "
36½ yards of white dimity	@	19¼c " "

3. On May 5, Donaldson Brothers, wholesale dry goods merchants, sold P. W. Smith the following merchandise:

6 Pieces Flannel @	75⅜c per yard
39^3, 37^2, 40, 38^3, 39^1, 40^1	
6 Pieces of Gingham @	19c per yard
58^3, 59^1, 57^3, 56^2, 59^1, 58^1	
8 Pieces of Prints @	16¾c per yard
42^1, 43^3, 44^1, 44^3, 45^1, 44^2, 43^3, 45	
12 Pieces of Linings @	39¼c per yard
44^1, 44^3, 45^2 46^1, 47, 48, 44^3, 43^3, 45^1, 46^2, 48^3, 47	

4.

SIMON, TUCKER & COMPANY
Wholesale Dry Goods Merchants

New York, May 10, 1926

SOLD TO: Messrs. B. T. Frank & Co.,
Albany, New York
Terms: 30 days

8	pieces Printz				$13\frac{3}{4}$c	
	41^1	42^2	39^3	40^1		
	41^3	41^2	40^2	39^3		
8	pieces Chiffon				1.85	
	37^2	38^3	40^2	42^1		
	41^3	37^1	39^2	41^3		
6	pieces Percale				$16\frac{1}{2}$c	
	56^1	54^2	53^1			
	53^2	54^3	52^3			
4	pieces Taffeta				1.47	
	49^3	53^1	54^2	51^2		

NOTE: The figures under the descriptions of the goods refer to the number of yards in each piece. The small figures indicate fourths of a yard. It is customary in the dry goods business to omit the denominator four, because practically all pieces are an exact number of yards or fourths of a yard. To complete the extensions copy the invoice on tablet paper, add the number of yards in each item, and write the total after the number of pieces given. Multiply the total by the price and write the result in the first money column at the right. The total of all the amounts written in this column will be the amount of the invoice.

5. Ascertain the value of the following drugs in the stock of the Dow Drug Company, December 31:

$126\frac{1}{4}$ doz. Mulsified Cocoanut Oil	@	$24\frac{1}{2}$c each
151 doz. D. & R. Cold Cream	@	$26\frac{3}{4}$c "
125 doz. Mavis Talcum Powder	@	$13\frac{1}{2}$c "
49 doz. Pinaud's Lilac Vegetal	@	$62\frac{1}{2}$c "
$46\frac{3}{4}$ doz. Pepsodent Tooth Paste	@	$25\frac{1}{2}$c "
58 doz. Lyons' Tooth Paste	@	$32\frac{3}{4}$c "
$56\frac{1}{4}$ doz. Palmolive Shampoo	@	$28\frac{3}{4}$c "
$62\frac{1}{2}$ doz. Vick's Salve	@	$41\frac{1}{4}$c "

6. The Chatfield Paper Company sold the Goodwill Printing Company the following merchandise on November 16:

$12\frac{1}{2}$ rms. Snowdrift Writing, 17×22, 24 lbs. per rm. @ $37\frac{1}{2}$c
$25\frac{2}{5}$ rms. Foldwell Writing, 22×34, 48 lbs. per rm. @ $18\frac{1}{2}$c
$57\frac{4}{5}$ rms. Paramount Bond, 17×28, $20\frac{1}{2}$ lbs. per rm., @ $13\frac{3}{4}$c
$42\frac{2}{5}$ rms. Triton Bond, 17×28, $25\frac{1}{2}$ lbs. per rm., at $15\frac{1}{4}$c

NOTE: Writing paper is manufactured in rolls, cut in sheets of standard sizes and wrapped in ream packages. When a purchase involves less than a ream, it is expressed in fractions. The number of pounds is ascertained by multiplying the number of reams by the weight per ream. The value of each quantity of paper is ascertained by multiplying the number of pounds by the price per pound. The standard ream contains 480 sheets made up of twenty quires, 24 sheets to the quire. Some mills wrap their paper in ream packages containing 500 sheets to the ream. Use 480 sheets to the ream in all of your calculations unless otherwise instructed in the problem.

7. Verify the following inventory of automobile accessories in the stock of the Western Auto Supply Company, December 31:

Merchandise Inventory, December 31, 19

45 Seat Covers	$ 7.57	$340	65		
26 Seat Covers	6.97$\frac{1}{2}$	181	35		
88 pairs Gauntlets	1.96$\frac{1}{2}$	173	92		
158 Steel Ratchet Valve Lifters	.16$\frac{1}{4}$	25	67		
253 Grease Guns	.46$\frac{1}{2}$	122	64		
74 Rubber Mats	.45$\frac{3}{4}$	34	03		
56 pkgs. Top Patching Material	.26$\frac{1}{3}$	12	85		
153 bottles Top Dressing	.35$\frac{2}{3}$	50	55		
584 Carburetor Adjusters	.76$\frac{1}{2}$	446	78		
352 Piston Rings	.08$\frac{1}{2}$	29	78		
226 Timers	.36$\frac{1}{4}$	81	83		
158 Headlamp Reflectors	.56$\frac{1}{2}$	89	27		
74 Headlamp Rims	.27$\frac{1}{4}$	20	27		
148 Stoplites	.57$\frac{1}{4}$	84	73		
96 Aluminum Step Plates	.87$\frac{1}{4}$	83	76		
Total				$1778	08

Show on tablet paper: (a) the calculations necessary to verify the extensions; and (b) the correct total of the inventory.

EXERCISE No. 92, ORAL PROBLEMS

1. At $8\frac{1}{3}$c a pound, how many pounds of sugar can you buy for a dollar?

2. If a messenger boy earns $\$1\frac{4}{5}$ a day, six days a week, how much does he earn in a week?

3. You and your school chum form a partnership for selling papers after school hours. The two of you together sell 800 papers for the week at 3c each. A profit of $1\frac{1}{4}$ cents is made on each paper sold. On Saturday night, when the profits are divided equally, how much does each one receive?

4. You have kept an accurate account of your school expenses for the month, including lunch, school supplies, carfare, etc. The total for the month amounts to $\$12\frac{4}{5}$. Counting 20 days to the school month, what were your expenses for the day?

5. You buy tickets for your carfare at the rate of 6 for 51c. You use 2 tickets per day for a school month of 20 days, what is your carfare per month? If your school runs ten months, what will your carfare cost for the year? How much will you save by walking $\frac{1}{5}$ of the time?

6. By selling eggs at 45c a dozen you gain $\frac{2}{3}$ of a cent apiece. How much would you have gained apiece by selling at 48c per dozen?

7. At 36c a dozen what would be the cost of 224 eggs?

8. At $16\frac{2}{3}$c a pound, what will a 25 pound box of prunes cost?

9. At $16\frac{1}{2}$c a pound what will $12\frac{1}{2}$ pounds of evaporated peaches cost?

10. I gain $1\frac{1}{3}$c each by selling apples at 5c apiece; what would I lose by selling them 3 for 10c?

11. From a piece of cloth containing $43\frac{3}{4}$ yards there were cut 9 dresses of $4\frac{1}{2}$ yards each. How many yards remained?

12. If $3\frac{1}{4}$ yards of cloth are required for one suit of clothes, how many suits can be cut from 39 yards?

13. You go to market with butter and eggs. The eggs bring you $4.00, which is $\frac{2}{3}$ of the value of the butter. What did you get for the butter?

14. Mrs. Brown bought two chickens weighing $3\frac{1}{4}$ and $3\frac{1}{2}$ pounds respectively, at 28c per pound. How much change will she get from a $5.00 bill?

15. A tract of land was sold at $110 per acre which was $\frac{2}{9}$ above cost. What was the cost per acre?

DIVISION OF COMMON FRACTIONS

The division of common fractions involves: (a) division of one fraction by another; (b) division of an integer by a fraction, or a fraction by an integer; (c) division of one mixed number by another; and (d) division of a mixed number by an integer, or an integer by a mixed number. The purpose of division of fractions is to ascertain the number of times, or fractional number of times, one fraction is contained in another fraction.

EXERCISE No. 93, DIVISION OF FRACTIONS

The following problems provide oral practice in the division of fractions. The numerator of the quotient is obtained by dividing the numerator of the dividend by the numerator of the divisor; the denominator of the quotient is obtained by dividing the denominator of the dividend by the denominator of the divisor. When the quotient is an improper fraction, reduce it to a mixed number, with the fraction of the mixed number in its lowest terms. In connection with each answer, state whether the quotient is of greater or less value than the dividend.

1	2	3	4	5
$a.\ \frac{1}{2} \div \frac{1}{2} =$	$a.\ \frac{8}{21} \div \frac{4}{7} =$	$a.\ \frac{6}{15} \div \frac{2}{3} =$	$a.\ \frac{18}{36} \div \frac{6}{18} =$	$a.\ \frac{130}{600} \div \frac{13}{15} =$
$b.\ \frac{1}{4} \div \frac{1}{2} =$	$b.\ \frac{8}{25} \div \frac{2}{5} =$	$b.\ \frac{4}{10} \div \frac{4}{5} =$	$b.\ \frac{22}{34} \div \frac{11}{17} =$	$b.\ \frac{18}{75} \div \frac{9}{25} =$
$c.\ \frac{3}{4} \div \frac{3}{4} =$	$c.\ \frac{9}{26} \div \frac{3}{2} =$	$c.\ \frac{7}{22} \div \frac{7}{2} =$	$c.\ \frac{27}{45} \div \frac{9}{15} =$	$c.\ \frac{27}{90} \div \frac{9}{30} =$
$d.\ \frac{4}{9} \div \frac{2}{3} =$	$d.\ \frac{14}{39} \div \frac{7}{3} =$	$d.\ \frac{6}{32} \div \frac{1}{2} =$	$d.\ \frac{18}{34} \div \frac{9}{17} =$	$d.\ \frac{55}{66} \div \frac{5}{11} =$

EXERCISE No. 94, DIVISION OF FRACTIONS

When the numerator of the divisor is not exactly contained in the numerator of the dividend, and the denominator of the divisor is not exactly contained in the denominator of the dividend, it is more convenient to invert the divisor and multiply. As explained in Exercise No. 71, the effect on the value of a fraction is the same whether the denominator is divided, or the numerator multiplied by a given number. $\frac{7}{8} \div \frac{7}{16}$ is the same as $\frac{7}{8} \times \frac{16}{7} = 2$. The sevens cancel each other, and eight is contained in sixteen two times, hence the quotient is 2. In other words $\frac{7}{16}$ is con-

tained in $\frac{7}{8}$, two times. This may be proved by multiplying $\frac{7}{16}$ by 2. ($\frac{7}{16} \times \frac{2}{1} = \frac{14}{16} = \frac{7}{8}$.)

The following problems provide oral practice in division when it is necessary to invert the divisor.

1. $\frac{1}{2} \div \frac{1}{4} =$	**6.** $\frac{1}{5} \div \frac{1}{2} =$	**11.** $\frac{5}{8} \div \frac{2}{3} =$	**16.** $\frac{5}{12} \div \frac{5}{8} =$	**21.** $\frac{26}{57} \div \frac{13}{19} =$
2. $\frac{1}{2} \div \frac{1}{3} =$	**7.** $\frac{1}{5} \div \frac{1}{4} =$	**12.** $\frac{1}{8} \div \frac{3}{5} =$	**17.** $\frac{9}{22} \div \frac{2}{7} =$	**22.** $\frac{17}{60} \div \frac{51}{75} =$
3. $\frac{1}{3} \div \frac{1}{2} =$	**8.** $\frac{1}{5} \div \frac{1}{8} =$	**13.** $\frac{1}{7} \div \frac{7}{8} =$	**18.** $\frac{25}{36} \div \frac{4}{5} =$	**23.** $\frac{26}{51} \div \frac{39}{68} =$
4. $\frac{2}{3} \div \frac{1}{2} =$	**9.** $\frac{1}{2} \div \frac{1}{5} =$	**14.** $\frac{4}{7} \div \frac{3}{7} =$	**19.** $\frac{18}{28} \div \frac{5}{6} =$	**24.** $\frac{32}{45} \div \frac{3}{5} =$
5. $\frac{1}{2} \div \frac{2}{3} =$	**10.** $\frac{1}{3} \div \frac{1}{6} =$	**15.** $\frac{5}{9} \div \frac{3}{5} =$	**20.** $\frac{20}{35} \div \frac{7}{8} =$	**25.** $\frac{27}{52} \div \frac{3}{8} =$

EXERCISE No. 95, DIVISION OF MIXED NUMBERS

When a problem requires the division of an integer by a mixed number, or vice versa, change the mixed number to an improper fraction, invert the divisor, multiply, and reduce the quotient to a mixed number with the fraction in its lowest terms. If desired, the integer and mixed number may each be multiplied by the denominator of the fraction, thereby removing the fraction. The process of division is then completed as in whol numbers with the quotient expressed as a mixed number, with the fraction reduced to its lowest terms.

The solution at the left shows the process when a mixed number is changed to an improper fraction, and the divisor inverted.

$84 \div 4\frac{1}{3} = 84 \div \frac{13}{3} = \frac{84}{1} \times \frac{3}{13} = \frac{252}{13} = 19\frac{5}{13}$

The solution at the right shows the process when both the dividend and divisor are multiplied by the denominator of the fraction, and the division completed as in whole numbers.

$84 \times 3 = 252;\ 4\frac{1}{3} \times 3 = 13$

$252 \div 13 = \frac{252}{13} = 19\frac{5}{13}$

The following problems provide written practice in dividing an integer by a mixed number, and a mixed number by an integer. You may solve the problems by either of the methods illustrated above, and prove the results by the other method. Show on tablet paper all of your calculations.

1	2	3
a. $176 \div 7\frac{2}{5} =$	*a.* $427\frac{1}{3} \div 16 =$	*a.* $729 \div 8\frac{2}{7} =$
b. $132 \div 5\frac{6}{7} =$	*b.* $141\frac{1}{2} \div 23 =$	*b.* $520 \div 8\frac{4}{8} =$
c. $237 \div 3\frac{3}{7} =$	*c.* $375\frac{2}{3} \div 41 =$	*c.* $360 \div 5\frac{2}{5} =$
d. $435 \div 8\frac{5}{8} =$	*d.* $245\frac{5}{6} \div 17 =$	*d.* $475 \div 8\frac{3}{4} =$
e. $682 \div 9\frac{2}{5} =$	*e.* $308\frac{2}{6} \div 21 =$	*e.* $178 \div 5\frac{2}{5} =$

EXERCISE No. 96, DIVISION OF MIXED NUMBERS

When a problem requires the division of one mixed number by another mixed number, change both mixed numbers to improper fractions, invert the divisor, multiply, and reduce the quotient to a mixed number with the fraction in its lowest terms. Cancellation should be used when possible.

The following problems provide written practice in the division of mixed numbers. Show all necessary calculations on tablet paper.

1	2	3
a. $3\frac{1}{2} \div 2\frac{1}{2} =$	*a.* $16\frac{2}{3} \div 6\frac{2}{3} =$	*a.* $18\frac{3}{5} \div 12\frac{2}{3} =$
b. $7\frac{1}{3} \div 2\frac{1}{2} =$	*b.* $18\frac{3}{4} \div 6\frac{1}{4} =$	*b.* $58\frac{1}{3} \div 12\frac{1}{2} =$
c. $9\frac{1}{4} \div 7\frac{1}{2} =$	*c.* $12\frac{1}{2} \div 4\frac{1}{2} =$	*c.* $93\frac{3}{4} \div 16\frac{2}{3} =$
d. $5\frac{1}{3} \div 4\frac{1}{3} =$	*d.* $22\frac{4}{9} \div 7\frac{2}{3} =$	*d.* $64\frac{3}{8} \div 15\frac{1}{3} =$
e. $6\frac{1}{6} \div 3\frac{1}{3} =$	*e.* $27\frac{3}{8} \div 3\frac{1}{2} =$	*e.* $52\frac{2}{9} \div 27\frac{4}{5} =$
f. $8\frac{2}{3} \div 2\frac{1}{3} =$	*f.* $32\frac{6}{7} \div 4\frac{3}{7} =$	*f.* $45\frac{3}{4} \div 22\frac{1}{2} =$

EXERCISE No. 97, FRACTIONAL RELATIONS

When it is desired to show the relation of one number to another, this is indicated by placing the numbers in the form of a fraction. Thus, if it is desired to know the relation of 5 to 20, the result expressed as a fraction would be $\frac{5}{20}$, which reduced to its lowest terms is $\frac{1}{4}$; hence, 5 is $\frac{1}{4}$ of 20.

The following problems provide oral practice in determining the relation of numbers.

The mental process of solution applied to the first problem would be: 2 is $\frac{1}{20}$ of 40, because the fraction, $\frac{2}{40} = \frac{1}{20}$ in its lowest terms; 4 is $\frac{1}{10}$ of 40, because the fraction, $\frac{4}{40}$, reduced to its lowest terms is $\frac{1}{10}$; 8 is $\frac{1}{5}$ of 40 because the fraction, $\frac{8}{40}$, reduced to its lowest terms is $\frac{1}{5}$, etc.

What fractional part of:

1. 40 is 2; 4; 8; 10; 20?
2. 24 is 2; 3; 4; 6; 8; 12?
3. 72 is 2; 3; 4; 6; 8; 9; 12; 18; 24; 36?
4. 48 is 2; 3; 4; 6; 8; 12; 24?
5. 50 is 2; 5; 10; 25?
6. 56 is 2; 4; 7; 8; 14; 28?
7. 80 is 2; 4; 5; 8; 10; 16; 20; 40?
8. 63 is 3; 7; 9; 21?

EXERCISE No. 98, FRACTIONAL RELATIONS

When the fractional part of a number is expressed as an integer, the value of the number may be determined by dividing the integer by the numerator and multiplying by the denominator of the fraction. If $\frac{2}{3}$ of a number is 20, and it is desired to ascertain the number, the following reasoning process will apply.

If $\frac{2}{3}$ of a certain number is 20, then $\frac{1}{3}$ of that number is $20 \div 2$ or 10; if $\frac{1}{3}$ of the desired number is 10, then $\frac{3}{3}$ of it would be three times 10, or 30.

The following problems provide oral practice in determining the number when a part of it is expressed as an integer.

1	2	3
a. 27 is $\frac{3}{4}$ of ?	*a*. 14 is $\frac{7}{8}$ of ?	*a*. 16 is $\frac{8}{9}$ of ?
b. 15 is $\frac{3}{5}$ of ?	*b*. 27 is $\frac{3}{5}$ of ?	*b*. 21 is $\frac{3}{5}$ of ?
c. 16 is $\frac{4}{5}$ of ?	*c*. 24 is $\frac{6}{7}$ of ?	*c*. 25 is $\frac{5}{6}$ of ?
d. 12 is $\frac{2}{3}$ of ?	*d*. 18 is $\frac{3}{4}$ of ?	*d*. 32 is $\frac{8}{9}$ of ?
e. 26 is $\frac{13}{14}$ of ?	*e*. 20 is $\frac{10}{11}$ of ?	*e*. 28 is $\frac{14}{15}$ of ?

EXERCISE No. 99, FRACTIONAL RELATIONS

The following problems provide written practice in determining the number when a part of it is expressed as a mixed number or a fraction.

1	2	3
a. $87\frac{1}{2}$ is $\frac{7}{8}$ of ?	*a*. $27\frac{1}{6}$ is $\frac{3}{8}$ of ?	*a*. $36\frac{3}{8}$ is $\frac{3}{5}$ of ?
b. $33\frac{1}{3}$ is $\frac{1}{3}$ of ?	*b*. $25\frac{3}{5}$ is $\frac{4}{7}$ of ?	*b*. $35\frac{3}{7}$ is $\frac{2}{7}$ of ?
c. $12\frac{5}{6}$ is $\frac{7}{8}$ of ?	*c*. $36\frac{1}{8}$ is $\frac{3}{5}$ of ?	*c*. $47\frac{1}{5}$ is $\frac{4}{5}$ of ?
d. $35\frac{3}{5}$ is $\frac{3}{4}$ of ?	*d*. $42\frac{1}{3}$ is $\frac{3}{7}$ of ?	*d*. $71\frac{1}{3}$ is $\frac{3}{4}$ of ?
e. $\frac{8}{9}$ is $\frac{3}{4}$ of ?	*e*. $\frac{3}{4}$ is $\frac{2}{3}$ of ?	*e*. $\frac{7}{9}$ is $\frac{1}{3}$ of ?

NOTE: The process is the same with a mixed number or a fraction as with an integer. When there is a mixed number in the problem, this should be changed to an improper fraction.

EXERCISE No. 100, COMPLEX FRACTIONS

The division of fractions may be expressed in the form of a complex fraction, that is, one fraction over another. If mixed numbers are involved, it is customary to change them to improper fractions when the expression is written in the form of a complex

fraction. The illustrations show the solution of the problem $7\frac{1}{8} \div 5\frac{1}{7}$.

$$7\tfrac{1}{8} \div 5\tfrac{1}{7} = \frac{7\frac{1}{8}}{5\frac{1}{7}} = \frac{\frac{57}{8}}{\frac{36}{7}} = \tfrac{57} \times \tfrac{7}{36} = \tfrac{399}{288} = \tfrac{133}{96} = 1\tfrac{37}{96}$$

In this solution, the mixed numbers are changed to improper fractions expressed as a complex fraction. Since the numerator is the dividend and the denominator, the divisor, the process of division here can be expressed as a complex fraction either, in the form of mixed numbers or improper fractions. $\frac{57}{8} \div \frac{36}{7}$ is equivalent to multiplication with the terms of the divisor inverted. The product, reduced to the form of a mixed number, with the fraction in its lowest terms, gives the number of times $5\frac{1}{7}$ is contained in $7\frac{1}{8}$.

$$7\tfrac{1}{8} \div 5\tfrac{1}{7} = \frac{\frac{57}{8}}{\frac{36}{7}} = \tfrac{57} \times \tfrac{7}{36} = \tfrac{399}{288} = 1\tfrac{111}{288} = 1\tfrac{37}{96}$$

Another method of performing the division indicated by a complex fraction is to multiply the two extreme numbers together for a new numerator and the two mean numbers for a new denominator. You will note by comparing this solution with the first illustration that the result is the same as inverting the divisor and multiplying.

$$7\tfrac{1}{8} \div 5\tfrac{1}{7} = \frac{\cancel{57}^{19}/\cancel{8}}{\cancel{36}^{12}/\cancel{7}} = \tfrac{7} \times \tfrac{19}{12} = \tfrac{133}{96} = 1\tfrac{37}{96}$$

In this solution, the cancellation is completed before multiplying the extremes together for a numerator, and the means together for a denominator. Referring to the second solution you will observe that cancellation could have been used before the multiplication process, but that the reduction was not made until after the improper fraction was reduced to a mixed number. The final results of the three processes are the same, hence one may be used as a means of proving the other.

The following problems provide written practice in the division of fractions when they are expressed in complex form. Show all of your calculations on tablet paper as in the illustrations.

1	2	3	4	5
a. $\frac{6\frac{3}{5}}{4\frac{1}{2}}$	a. $\frac{3\frac{3}{8}}{5\frac{6}{7}}$	a. $\frac{10\frac{2}{3}}{12\frac{3}{4}}$	a. $\frac{42\frac{7}{8}}{36\frac{1}{4}}$	a. $\frac{58\frac{1}{4}}{32\frac{1}{7}}$
b. $\frac{5\frac{2}{3}}{6\frac{1}{3}}$	b. $\frac{3\frac{2}{3}}{7\frac{8}{9}}$	b. $\frac{17\frac{1}{2}}{11\frac{1}{5}}$	b. $\frac{39\frac{1}{7}}{24\frac{1}{3}}$	b. $\frac{43\frac{2}{5}}{27\frac{1}{3}}$
c. $\frac{4\frac{2}{7}}{5\frac{3}{5}}$	c. $\frac{8\frac{3}{6}}{4\frac{1}{2}}$	c. $\frac{23\frac{2}{5}}{16\frac{3}{4}}$	c. $\frac{45\frac{1}{5}}{19\frac{5}{6}}$	c. $\frac{36\frac{1}{9}}{18\frac{1}{3}}$

EXERCISE No. 101, FRACTIONS APPLIED TO DENOMINATE NUMBERS

When a fraction is applicable to an abstract number, and is expressed in its lowest terms, there is no other means of expressing the fractional value. When a fraction is applicable to a concrete number, its value may be expressed in other concrete terms which bear a definite relation to the concrete number. Thus, the fraction "$\frac{3}{4}$" indicates that an abstract unit is divided into 4 equal parts and 3 parts are expressed. The expression "$\frac{3}{4}$ of a dozen" is applicable to 12 because 12 units make a dozen, hence might be expressed as 9. The fraction "$\frac{1}{2}$ of a bushel" might be expressed as 2 pecks because there are 4 pecks in a bushel.

The following problems provide oral practice in expressing fractional values applicable to concrete numbers in another form. These problems serve two purposes: (a) as a review of measurements learned in the preceding study of arithmetic, and (b) the expression of a fraction in more than one form without a change in its value.

1	2	3
a. $\frac{3}{4}$ of a yard	*a.* $\frac{3}{4}$ of a pound	*a.* $\frac{1}{2}$ of a ton
b. $\frac{5}{8}$ of a bushel	*b.* $\frac{1}{2}$ of a quart	*b.* $\frac{3}{4}$ of a dollar
c. $\frac{3}{4}$ of a gallon	*c.* $\frac{2}{3}$ of a yard	*c.* $\frac{1}{5}$ of a quarter
d. $\frac{5}{6}$ of a foot	*d.* $\frac{1}{4}$ of a gallon	*d.* $\frac{1}{2}$ of a rod
e. $\frac{7}{12}$ of a dozen	*e.* $\frac{3}{8}$ of a pound	*e.* $\frac{1}{8}$ of a pound

EXERCISE No. 102, ORAL PROBLEMS

1. A merchant's debts amount to \$2,500, which is $\frac{1}{7}$ of his assets. What is the value of his assets and what is his net worth?

NOTE: Assets − debts = net worth.

2. The stock of a bankrupt merchant was sold for \$24,000, which was $\frac{2}{3}$ of the cost. What was the cost of the stock? What was the loss?

3. What will $2\frac{1}{4}$ yards of silk cost at $\$5\frac{1}{2}$ per yard?

4. Bananas are priced at 40c per dozen. How many can you buy for 10c?

5. A merchant sells apples 3 for 10c. If a box contains 120 apples, what will he get for them? If he bought them at the rate of 4 for 10c, what is his gross profit on the box of apples?

6. A family saves \$960 per year, which is $\frac{3}{8}$ of its income. What is the income?

7. If you perform $\frac{1}{1\frac{1}{2}}$ of a certain piece of work in the first week, working 6 days per week, how many days will it take to complete the task?

8. If a boy can earn $3\frac{1}{2}$ dollars per day, how much will he earn in a month of 26 working days?

9. The athletic association of a school collected \$820 for the year. $\frac{1}{8}$ was for basket ball, $\frac{1}{4}$ for baseball, $\frac{1}{2}$ for football and the remainder for hockey. How much was collected for each?

10. A farmer sold $\frac{4}{9}$ of his apples for \$120.00. What is the value of the entire crop?

11. A girl bought 4 apples at $5\frac{1}{2}$c each. How much change did she receive if she gave the clerk a quarter?

12. How much will be saved on 12 rides by buying street car tickets if the cash fare is 10 cents and tickets sell for $8\frac{1}{3}$c each?

13. Mrs. Smith bought $2\frac{1}{2}$ yards crepe satin, \$2.50 a yard and 3 yards muslin at $18\frac{1}{2}$c a yard. What was the amount of her purchase?

14. What is the cost of $3\frac{1}{3}$ dozens eggs at 60 cents per dozen?

15. A milliner sold one dozen hats for \$3.60 each, this was one third above cost. What was the cost price of each hat? What was the profit on all the hats?

CHAPTER X

PRACTICAL PROBLEMS IN COMMON FRACTIONS

The purpose of this chapter is to provide practical problems in addition, subtraction, multiplication, and division when common fractions are involved.

1. In a test an automobile ran 28 miles in 30 minutes. At this rate, how many miles would it travel in $6\frac{1}{2}$ hours?

2. A farm containing 640 acres of land has 200 acres planted in corn, $\frac{1}{4}$ of the remainder in oats, $\frac{1}{3}$ of the remainder in barley, $\frac{2}{3}$ of the remainder in orchard, and the balance in pasture. What is the acreage of each?

3. The distance between Chicago and Waukegan by automobile is 40 miles, which is $\frac{2}{5}$ of the distance between Chicago and Milwaukee. What is the distance between Chicago and Milwaukee?

4. An automobile, operated between Chicago and Milwaukee, consumed $6\frac{5}{8}$ gallons of gasoline at $22\frac{1}{2}$c per gallon. (a) What did the gasoline cost for one trip? (b) What was the average number of miles per gallon?

5. Wheat was quoted at the opening of the market on Monday at \$1.57; on Tuesday, \$1.57$\frac{1}{2}$; on Wednesday, \$1.56$\frac{3}{4}$; on Thursday, \$1.56$\frac{1}{4}$; on Friday, \$1.55$\frac{1}{2}$; on Saturday, \$1.55$\frac{3}{4}$. What was the average quotation for the week?

6. If you pay 20c for three pounds of potatoes, how much do you pay (a) for a bushel of 60 pounds at the same price? (b) For a peck, which is $\frac{1}{4}$ of a bushel?

7. A retail merchant buys beans at \$4.50 per hundred pounds. He sells them at three pounds for 25c. What is his gain (a) per pound? (b) Per hundred pounds?

8. Divide \$90 between two boys so that the first boy will have (a) $\frac{2}{3}$ as much as the second boy; (b) $\frac{2}{3}$ less than the second boy; and (c) $\frac{2}{3}$ more than the second boy.

9. An office building was insured for \$60,000 and the policies were written by three companies as follows: Company A, policy for \$15,000; Company B, policy for \$20,000; Company C, policy for \$25,000. The building was damaged by fire to the extent of \$18,000. What part of the loss should each company pay?

10. You gave a clerk a five-dollar bill in payment for the following: 4 pounds of coffee at $35\frac{3}{4}$c; 6 pounds of onions at $6\frac{1}{2}$c; $12\frac{1}{4}$ pounds of flour at 4c; $\frac{1}{2}$ pound of pepper at 48c a pound. (a) How much change should you receive? (b) In what denominations?

11. 36,630 pounds of wheat were put into sacks averaging $2\frac{1}{2}$ bushels (60 lbs. per bu.) to the sack. How many sacks were required?

12. By rearranging and installing new machinery, a factory increased production by $\frac{1}{3}$. At the same time the working hours were reduced from 10 to 8 hours. Was there an increase or decrease in production? How much?

13. Find the cost of $26\frac{1}{2}$ pounds of prunes at $27\frac{1}{2}$c per pound: and $16\frac{1}{2}$ pounds of raisins at $18\frac{3}{4}$c per pound.

14. I spent $\frac{1}{3}$ of my money and lent $\frac{5}{6}$ of the remainder. What part did I have left?

15. $\frac{1}{6}$ of a bushel of wheat (60 lbs.) is what part of $\frac{3}{5}$ of a bushel of wheat? Express your answer fractionally, and prove by the number of pounds.

16. What fraction of a ton of 2,000 pounds is 1,760 pounds?

17. A farmer sold to a merchant 14 dozen eggs at $42\frac{1}{4}$c, and $16\frac{1}{2}$ pounds of butter at 44c. He purchased from the merchant 6 pounds of sugar at $7\frac{1}{2}$c and 4 pounds of coffee at $38\frac{1}{2}$c. Who pays the difference, the farmer or the merchant? How much?

18. A dealer paid \$5.75 for a ton of coal (2000 lbs.), and retailed it at $42\frac{1}{2}$c per bushel (80 lbs.). What was his profit?

19. $\frac{7}{9}$ added to a certain fraction gives $1\frac{5}{6}$. Find the fraction.

20. If the sum of two numbers is $95\frac{1}{12}$ and one of the numbers is $67\frac{11}{15}$, what is the other number?

21. What number divided by $2\frac{3}{8}$ will equal $12\frac{14}{48}$?

22. A. B. Jones and T. G. Smith contract to do a piece of work for $625. Jones works 65 days and Smith 35 days. How should the money be divided?

23. If you travel 75 miles by automobile on 7 gallons of gasoline, how many gallons will be required to make a trip of 350 miles?

24. What is the cost of $14\frac{1}{2}$ gross note books at $4\frac{3}{4}$c each?

NOTE: A gross is 12 dozen.

25. A farmer sold $\frac{3}{4}$ of a bushel of seed potatoes for $2.50. At the same price, what would he receive for his crop of 75 bushels?

26. Two brothers paid $2,400 for a farm, each paying half. Each sold $\frac{1}{4}$ of his interest to a third brother at cost (a) What fractional part of the total investment does each brother now own, and (b) what is the value of the investment of each?

27. If you paid $8\frac{1}{4}$c per yard for $10\frac{1}{2}$ yards of ribbon, and $16\frac{2}{3}$c per yard for 9 yards of gingham, (a) what change would you receive from a five-dollar bill? (b) In what denominations?

28. A box of apples containing 144 apples was purchased for $2\frac{1}{2}$c per apple and sold at $\frac{6}{5}$ of the cost. What was the profit?

29. Three railroads carry goods a distance of 1,560 miles for $7.50. If the distance carried by the first road is 780 miles, the second, 520 miles, and the remainder by the third road, how would the charge of $7.50 be divided?

30. A box of 10 dozen oranges cost $4. If one dozen froze and the remainder were sold at $4\frac{1}{6}$c each, what was the profit?

31. Five dressed hogs weighed $150\frac{1}{4}$ lbs., $180\frac{2}{3}$ lbs., $165\frac{1}{2}$ lbs., $138\frac{3}{4}$ lbs., and $186\frac{1}{3}$ lbs. What was (a) the average weight, and (b) the total cost of the five hogs at $16\frac{2}{3}$c per pound.

32. A lot is $50\frac{1}{4}$ feet wide by $80\frac{2}{3}$ feet deep. How many rods ($16\frac{1}{2}$ ft.) of woven wire will be required to fence the lot?

33. Find the cost of the butter in 5 tubs weighing $33\frac{1}{2}$ pounds, $34\frac{1}{4}$ pounds, $31\frac{1}{8}$ pounds, $30\frac{3}{4}$ pounds, and $31\frac{1}{3}$ pounds, if the tubs average $4\frac{1}{2}$ pounds each, and the butter is billed at $37\frac{3}{4}$c per pound.

34. Multiply the sum of $\frac{7}{8}$ and $\frac{2}{3}$ by their difference.

35. A boy rides a bicycle 7 miles in $\frac{3}{4}$ of an hour. At the same rate, how long would it take him to ride $20\frac{3}{4}$ miles?

36. A merchant owned $\frac{3}{8}$ of an interest in a store and sold $\frac{1}{2}$ of his interest for \$6,000. What was (a) the total value of the store, and (b) the value of his remaining interest?

37. A merchant asked $\frac{1}{2}$ more for an article than it cost. During a dull season he reduced the market price $\frac{1}{5}$. If he gained \$2.40, what was (a) the cost, and (b) the selling price?

38. Jones and Smith, two merchants, each made a bid on a certain lot of merchandise. Jones' offer was $\frac{4}{5}$ of the cost value, and Smith's offer was $\frac{6}{7}$ of the cost value. If their offers differed to the amount of \$960, (a) what was the cost value of the merchandise; (b) how many dollars did Jones offer for it; and (c) how many dollars did Smith offer for it?

39. Find the cost of the following: $37\frac{1}{2}$ pounds of tea at $62\frac{1}{2}$c per pound; $42\frac{1}{2}$ pounds of coffee at $41\frac{3}{4}$c per pound; $5\frac{1}{2}$ pounds of pepper at $58\frac{1}{2}$c per pound; $37\frac{1}{2}$ pounds of lard at $25\frac{1}{2}$c per pound.

40. Find the sum of the results:

$(16\frac{2}{3}+27\frac{1}{3}-12\frac{1}{6})\times 3\frac{5}{7}$

$90\frac{1}{2}\div 10\frac{1}{2}+125\frac{1}{7}-81\frac{1}{3}$

$(12\frac{1}{6}+50\frac{5}{6}+40\frac{1}{3}-76\frac{2}{3})\times 3\frac{1}{4}$

41. Find the sum of the sum, difference, product, and quotient of $16\frac{1}{2}$ and $3\frac{1}{4}$.

42. A merchant bought 12 pieces of denim as follows: $40\frac{1}{2}$, $43\frac{1}{4}$, $41\frac{1}{4}$, $41\frac{1}{2}$, $44\frac{1}{4}$, $43\frac{3}{4}$, $40\frac{1}{2}$, $40\frac{1}{4}$, $42\frac{1}{2}$, $41\frac{3}{4}$, $42\frac{1}{4}$, $40\frac{1}{2}$ yards at $16\frac{2}{3}$c per yard. What was the cost?

43. A dealer bought grain at $\frac{9}{10}$ of the market price and sold it later for $1\frac{3}{2}$ of the former market price. If he gained \$66, how much did he pay for the grain?

44. Alfred Johnson works the following number of hours during the seven days beginning with Monday, May 9: Monday, $9\frac{2}{5}$; Tuesday, $9\frac{3}{4}$; Wednesday, $10\frac{3}{10}$; Thursday, $7\frac{7}{10}$; Friday, $9\frac{3}{4}$; Saturday, $9\frac{3}{5}$; Sunday, $8\frac{1}{2}$. His wages are $\$1.23\frac{1}{4}$ per hour for eight hours each day, time and a half for all time over eight hours each day, and double time for Sunday. How much was due him for the time worked during the seven days?

45. What is the number whose $\frac{4}{5}$ exceeds its $\frac{2}{3}$ by 60?

46. By what number must $\frac{5}{6}$ be multiplied to produce 1,704?

47. I bought 25 turkeys for \$145.50. (a) If the average weight is $10\frac{4}{5}$ pounds, how much did I pay per pound? (b) If I desire a profit of $\frac{1}{5}$ of cost, at what price per pound must I sell them?

48. Four men are partners in the general merchandise business and gain the first year, \$6,250. If they share the profits $\frac{2}{5}$, $\frac{1}{4}$, $\frac{1}{5}$, and $\frac{3}{20}$ respectively, how much will each get?

49. A man's liabilities are equal to $\frac{3}{4}$ of his assets. If his assets amount to \$48,000, what is his net worth?

50. A speculator gained $\frac{1}{20}$ on stock he sold at \$84. Had he sold 10 days later when it was quoted at \$90, (a) what would have been his gain? (b) What would he have lost, if he had sold at \$75?

51. A merchant bought a box of 120 apples at the rate of 3 for 5c. 18 were bruised and unfit for sale. He sold the others at the rate of 3 for 10c. What was his profit?

52. I bought 10 bags of wheat weighing $120\frac{1}{2}$, $122\frac{1}{4}$, $119\frac{3}{4}$, $121\frac{1}{2}$, $122\frac{3}{4}$, $119\frac{1}{2}$, $122\frac{1}{2}$, $120\frac{1}{4}$, 121, $123\frac{1}{4}$ pounds respectively. If I paid \$1.55 per bushel, allowing one pound each for the weight of the bags, what was the cost of the wheat?

53. I sold $\frac{3}{5}$ of my property for \$7,500. The part I have remaining at the same rate is worth $\frac{4}{5}$ of the original cost of the entire property. What was the cost?

54. A, B, and C are partners in a business, each owning $\frac{1}{3}$. A sold $\frac{1}{3}$ of his interest to B, and the remainder to C. What part does B and C each now own?

55. A man speculated in grain and lost $\frac{1}{3}$ of his investment. The next year he gained \$600, and then had \$2,600. What was his original investment?

56. The sum of two numbers is $48\frac{1}{4}$. Their difference is $6\frac{3}{4}$. What is the product of the numbers?

57. A, B, C, and D invest \$1,200, \$1,500, \$2,500, and \$1,000 respectively. They are to share gains or losses in proportion to capital invested. In the first year their profit was \$3,459.60. What will each receive?

58. A box of books weighed 384 pounds gross. If the box weighed 36 pounds, what is the fractional weight of both the box and its contents?

59. The distance between Harrisburg, Pennsylvania, and Erie, Pennsylvania, by one route, is $340\frac{1}{5}$ miles. Lock Haven, Pennsylvania, is on the same line of railroad as that between Harrisburg and Erie, and is $117\frac{7}{10}$ miles from Harrisburg. (a) What is the distance between Lock Haven and Erie? (b) How much farther is Lock Haven from Erie than from Harrisburg? (c) What fractional part of the entire distance between Harrisburg and Erie is the distance from Emporium which is $191\frac{4}{5}$ miles from Harrisburg?

60. Find the sum of the sum, difference, and product of $42\frac{7}{8}$ and $15\frac{1}{3}$.

61. A merchant bought 3,650 yards of silk at $\$1.12\frac{1}{2}$ per yard and sold $\frac{4}{5}$ of it at $\frac{3}{8}$ above cost. He had a special sale and reduced the selling price of the remainder $\frac{1}{3}$. It was all sold. What was his profit?

62. In a manufacturing plant $\frac{2}{5}$ of the space is given to machinery, $\frac{3}{10}$ to stores, $\frac{1}{5}$ to assembling and shipping, and the remainder, 1,200 square feet, is used for offices. How many square feet is occupied by each?

63. A grocer purchased a case of canned peaches containing 4 dozen cans for \$6.36. He retailed them at $17\frac{1}{2}$c per can. (a) What was his profit, and (b) what fraction of the cost price was this profit?

64. Two fields are the same width, but one is $\frac{1}{5}$ longer than the other. If the smaller contains 35 acres, how many acres are there in both fields?

65. Multiply $145\frac{2}{3}$ by $12\frac{1}{4}$, and divide the product by $25\frac{1}{2}$.

66. A stock of merchandise is marked $\frac{1}{4}$ above cost, but on account of damage by water is sold at $\frac{1}{3}$ of the marked price. If the loss is \$600, what was (a) the cost and (b) the selling price?

67. What will $31\frac{1}{2}$ gallons of vinegar cost if $2\frac{1}{2}$ gallons cost 94c?

68. I gave a twenty-dollar bill in payment of 9 pounds of nuts at $16\frac{2}{3}$c per pound, 12 pounds of coffee at $37\frac{1}{2}$c per pound, and $12\frac{1}{2}$ pounds of butter at 48c per pound. What change should I receive?

69. A. L. Day, W. O. Marx, and E. F. Watts formed a partnership to operate a garage. It was agreed that each partner should share in the profits according to the amounts invested. Day invested \$1,500; Marx invested \$900; Watts invested \$1,200. After operating the garage for three months, the partners sold the business for \$5,400. You are to ascertain how the sale price was divided among the partners in accordance with their agreement.

70. Andrews, Arnold, and Anderson rented a pasture for \$48 per month. Andrews had 6 cows, Arnold, 5 cows, and Anderson 8 cows. It was agreed that each would pay a portion of the rent based on the number of cows pastured. How much was each required to pay based on this agreement?

71. Johnson and Smith operated a bus line between two towns. The profit was shared in proportion to the investment. Johnson invested \$2,750 and Smith, \$3,750. During the month of June the profits were \$128.50. What part of this profit did each partner receive?

72. A book contained 416 pages. It was printed on paper 36 by 48 inches, 32 pages on each side of a sheet. (a) How many pounds of paper would be needed to print 10,000 of these books allowing $\frac{1}{5}\frac{1}{0}$ for waste, if each ream of paper weighs 120 pounds and contains 500 sheets? (b) What would be the cost of the paper at $11\frac{5}{8}$c per pound?

73. C. E. Herzog sold a lot fronting $62\frac{1}{2}$ feet on Main Street for \$1,718.75. How much did I. L. Campbell receive for the adjoining lot which has a frontage of $72\frac{1}{2}$ feet, if he sold it at the same price per front foot.

74. Robert Douglas owed Brown Brothers, retail merchants, \$187.65. What was the balance of his indebtedness, if Brown Brothers accepted in part payment, 127 dozen eggs at $41\frac{1}{2}$c per dozen and 62 pounds of butter at $39\frac{1}{2}$c per pound?

75. How much profit is made by purchasing 1760 lbs. of wool at $17\frac{1}{2}$c per pound, and selling it at $32\frac{3}{8}$c per pound, after paying freight charges of $\$1.25\frac{1}{4}$ per hundred pounds?

76. The A. & B. railroad purchased a right of way through the farm of Russell Mann. It was agreed to pay him \$120 per

acre for the ground used by the railroad. How much did he receive if the right of way was 99 feet wide and 480 rods long?

NOTE: A rod is $16\frac{1}{2}$ feet, and an acre contains 160 square rods.

77. A lot, 150 feet by 300 feet, was sold for $22,500. What was the price per acre?

78. What is the selling price of three bales of cotton weighing $498\frac{1}{2}$ pounds, $502\frac{3}{4}$ pounds, $501\frac{3}{8}$ pounds at $20\frac{7}{8}$c per pound?

79. A merchant had a pecan grove of 125 trees that averaged 55 pounds to the tree. He sold one half of his crop at $10\frac{1}{2}$c per pound, and the other half for $12\frac{1}{2}$c per pound. How much did he receive for the entire crop?

80. H. B. Fall, a farmer, sold 22,581 pounds of seed cotton at $7\frac{3}{8}$c per pound. How much did he receive for it?

81. Find the sum of the difference and product of $61\frac{1}{4}$ and $38\frac{2}{3}$.

82. Mrs. Smith bought the following dry goods: $4\frac{1}{2}$ yards pongee at $1.12 per yard; 6 yards muslin at $18\frac{1}{3}$c per yard; 16 yards filet lace edging at $8\frac{1}{2}$c per yard. What is the total amount of her purchase?

83. How much will it cost to build 94 feet of wire fence at $1.56\frac{1}{2}$ per foot?

84. A boy saves one fifth of his income each week and gives one tenth of the remainder to charity. If his income is $25 per week, (a) how much will he save each week; (b) how much will he give to charity in 12 weeks time?

85. A boy earns $6 for $10\frac{1}{2}$ hours work each week; another boy earns 50 cents an hour for 2 hours and 15 minutes work on each of six days. Each boy deposits $\frac{1}{4}$ of his weekly earnings in a savings account in a bank. (a) What is the difference in the weekly earnings of each boy; (b) in the weekly savings?

CHAPTER XI

DECIMAL FRACTIONS

There are two methods of writing a fractional value, (a) by placing the numerator over the denominator, and (b) by writing the numerator and indicating the denominator by the decimal point; when both the numerator and denominator are written, it is known as a common fraction, and when the denominator is expressed by a decimal point, as a decimal fraction. A fractional value can be expressed decimally only when the denominator is ten or a power of ten. The denominator of a decimal fraction is determined by the position of the figures which express the value of the numerator and their relation to the decimal point.

The fractional value, one tenth, written as a common fraction is $\frac{1}{10}$, and as a decimal fraction, .1; seven tenths, as $\frac{7}{10}$ or .7; twenty-seven hundredths, as $\frac{27}{100}$ or .27; seven hundredths, as $\frac{7}{100}$ or .07. You will observe that when there are not a sufficient number of figures in the numerator to indicate the denominator that ciphers are placed between the decimal point and the figure or figures in the numerator. Thus, in writing the fractional value, seven hundredths, as a decimal, it is necessary to place a cipher between the 7 and the decimal point, otherwise the value of the fraction would be seven tenths. There must be as many figures at the right of the decimal point as there are ciphers in the denominator if the fraction were expressed as a common fraction.

EXERCISE No. 103, EXPRESSING FRACTIONS

The problems on page 141 provide oral practice in expressing fractional values both by common and decimal fractions. As the fractions are read you are to describe the method of writing both as a common fraction and as a decimal fraction.

The enumeration is from the right of the decimal point to the right beginning with tenths. Thus, a decimal fraction with a

denominator of hundredths will have two decimal places; thousandths, three decimal places; ten-thousandths, four decimal places; hundred-thousandths, five decimal places, etc.

NOTE: The word "and" in decimal fractions, indicates a mixed decimal, and denotes the decimal point; it connects the whole number and the decimal fraction. It is also used in reading a complex decimal.

1. Ninety-nine hundredths
2. One hundred seventy-five thousandths
3. One hundred and seventy-five thousandths
4. Sixteen ten-thousandths
5. Seven hundred fifty-five ten-thousandths
6. Seven and two thirds of a thousandth
7. Seven and three and two thirds thousandths
8. Thirty-one and thirteen hundredths
9. Seventy-seven hundred-thousandths
10. Two thousand and twenty-five ten-thousandths
11. Two hundred fifteen ten-thousandths
12. Three thousand seventy-five hundred-thousandths
13. Forty-four hundredths
14. Seventy-eight hundred-thousandths
15. Sixty-five ten-thousandths
16. Four hundred ten thousandths
17. Five hundred sixty-five hundred-thousandths
18. Five hundred and one ten-thousandths
19. Seventeen thousandths
20. Five thousand five hundred fifty-five hundred-thousandths
21. Thirty-one thousandths
22. One hundred thousandths
23. Five hundred one ten-thousandths
24. Eighteen thousand three hundred forty-one hundred-thousandths
25. Thirteen ten-thousandths
26. One hundred and three thousand one hundred thirty-six ten-thousandths
27. One and sixteen thousandths

EXERCISE No. 104, CHANGING COMMON FRACTIONS TO DECIMALS

When it is desired to express a fractional value shown in common fraction form as a decimal fraction, it is necessary to reduce the fraction to its equivalent value in tenths, hundredths, thousandths, etc. This reduction may be made (a) by multiplying the numerator and the denominator by a number which will express the denominator as tenths, hundredths, thousandths, etc., or (b) to divide the numerator by the denominator. The method of reducing common fractions to decimals by multiplying the denominator and the numerator by the required number is illustrated in this exercise; the method of reduction by division will be illustrated in a subsequent exercise.

When it is desired to express a common fraction in decimal form, and ten or a power of ten is divisible by the denominator without a remainder, divide by the denominator and multiply the numerator by the quotient. The illustration below shows the process of expressing the fractions, $\frac{1}{2}$, $\frac{3}{4}$, $\frac{2}{5}$, and $\frac{5}{8}$ in decimal form.

$\frac{1}{2} \times \frac{5}{5} = \frac{5}{10} = .5$
$\frac{3}{4} \times \frac{25}{25} = \frac{75}{100} = .75$
$\frac{2}{5} \times \frac{2}{2} = \frac{4}{10} = .4$
$\frac{5}{8} \times \frac{125}{125} = \frac{625}{1000} = .625$

To express the fraction, $\frac{1}{2}$, as a decimal, it is necessary to secure a denominator of 10 or a power of 10. Since 2 is contained in 10 without a remainder, both the numerator and denominator are multiplied by the quotient resulting from dividing 10 by 2. The value of the fraction will be expressed in tenths. This plan is followed in the illustration at the left. The fraction $\frac{5}{10}$ can be changed to decimal form by omitting the denominator and placing the decimal point at the left of the numerator.

The fraction, $\frac{3}{4}$, cannot be expressed as tenths, because 4 is not contained in 10 an even number of times. However, it can be expressed as hundredths, since 4 is contained in 100, 25 times.

The fraction, $\frac{2}{5}$, can be expressed as tenths because 5 is contained in 10, 2 times.

The fraction, $\frac{5}{8}$, cannot be expressed as tenths or hundredths, because 8 is not contained an even number of times in 10 or 100, but it is contained in 1,000 an even number of times.

The following problems provide written practice in changing common fractions to decimal fractions by the process explained and illustrated above. Arrange your work on tablet paper in the same form as in the illustration.

1.	2.	3.	4.
a. $\frac{7}{25}$	*a.* $\frac{3}{4}$	*a.* $\frac{4}{25}$	*a.* $\frac{4}{5}$
b. $\frac{27}{125}$	*b.* $\frac{15}{80}$	*b.* $\frac{9}{40}$	*b.* $\frac{21}{400}$
c. $\frac{9}{50}$	*c.* $\frac{18}{25}$	*c.* $\frac{1}{5}$	*c.* $\frac{63}{125}$
d. $\frac{5}{8}$	*d.* $\frac{17}{20}$	*d.* $\frac{11}{40}$	*d.* $\frac{5}{16}$

EXERCISE No. 105, CHANGING DECIMALS TO COMMON FRACTIONS

When it is desired to express the value of a decimal fraction as a common fraction, place the denominator indicated by the value of the numerator under the numerator, and reduce the fraction to its lowest terms. Thus, .5 indicates the value, five tenths. This expressed as a common fraction would be $\frac{5}{10}$, which reduced to its lowest term is $\frac{1}{2}$.

The following problems provide written practice in expressing decimal fractions in the form of common fractions of equivalent value. Show all of your calculations on tablet paper.

1.	2.	3.	4.
a. .55	*a.* .375	*a.* .36	*a.* .46
b. .82	*b.* .1875	*b.* .750	*b.* .09
c. .06	*c.* .0025	*c.* .3125	*c.* .07
d. .625	*d.* .4755	*d.* .33$\frac{1}{3}$	*d.* .08$\frac{1}{3}$
e. .45	*e.* .0125	*e.* .12$\frac{1}{2}$	*e.* .31

ADDITION OF DECIMAL FRACTIONS

The addition of decimal fractions is for the same purpose as the addition of common fractions; that is, to ascertain the sum of two or more fractional values. The process of addition in decimal fractions is the same as in whole numbers after the numbers to be added are arranged so that units are under units, tens under tens, etc. As in the addition of whole numbers or common fractions, the sum will be greater than the value of any one of the numbers added. The sum should be written as in whole numbers keeping the decimal point in the same position in the sum as it is in the numbers added. If the sum of the decimals added is equal to or greater than one, the whole number is written at the left of the decimal point.

EXERCISE No. 106, ADDITION OF DECIMAL FRACTIONS

The following problems provide written practice in the addition of fractional values expressed as decimal fractions. Show on tablet paper, (a) the sum of each column added, (b) the sum of all the columns, and (c) the proof by reverse addition.

a	*b*	*c*	*d*	*e*	*f*	*g*	*h*
.7	.3	.4975	.09	.9518	.723	.1824	.902
.16	.19	.5421	.7	.321	.12	.2071	.738
.395	.457	.9814	.625	.576	.519	.6925	.476
.9999	.3119	.7746	.8712	.743	.4897	.7298	.35
.2142	.5678	.2132	.3875	.9182	.7139	.5802	.4
.756	.245	.6539	.506	.8273	.4532	.9009	.712
.85	.37	.9001	.9	.123	.898	.3116	.29
.9	.5	.2078	.12	.4561	.424	.8195	.9916

EXERCISE No. 107, CALLING DECIMALS

As explained in a previous exercise, two parties are involved in calling figures, because the only purpose in calling is to write or check the amount called. The two parties involved should agree upon a code so that there may be no misunderstanding.

The following problems provide practice in calling and writing decimals, and in addition of decimals. You will show on tablet paper: (a) the sum of each column added; (b) the sum of all the columns; and (c) the proof by reverse addition.

a	*b*	*c*	*d*	*e*	*f*	*g*	*h*
.769	.3	.3014	.509	.7568	.3225	.8	.2029
.131	.05	.3247	.1492	.3539	.5	.39	.0102
.8694	.225	.4639	.675	.209	.23	.009	.112
.37	.3579	.2001	.5559	.7	.4071	.881	.295
.4	.2468	.1918	.1263	.3215	.0003	.9532	.48
.0006	.875	.3575	.2198	.03	.913	.7581	.002
.3769	.19	.1827	.48	.9182	.429	.133	.21
.538	.37	.2112	.048	.6	.0005	.325	.301
.06	.7	.1444	.01	.3008	.192	.29	.221
.9	.9	.5053	.0001	.17	.02	.4	.848

EXERCISE No. 108, ADDITION OF MIXED DECIMALS

The process of addition of mixed decimals is the same as the addition of decimals. The whole number is written at the left of the decimal point and the fraction at the right. Place tenths under tenths, hundredths under hundredths, etc. The enumeration of the decimal is from left to right beginning with tenths, and the enumeration of the whole number is from right to left beginning with units.

The following problems provide written practice in addition of mixed decimals. Show on tablet paper: (a) the sum of each column; (b) the sum of all the columns; and (c) proof by reverse addition.

a	*b*	*c*	*d*
2098.1801	1598.09	9.8	1234.5678
5756.1982	7.75	13.21	356.102
9521.0019	918.625	625.505	27.01
1532.1492	1098.1444	1492.7981	3.3
1444.0509	509.7	1001.4332	7.8
7582.6257	37.67	509.111	31.67
1337.2118	112.111	21.75	999.107
3022.6029	1.0007	1.1	1776.1924

EXERCISE No. 109, CALLING MIXED DECIMALS

The following problems provide practice in calling and writing mixed decimals when the fractional values are expressed decimally. Find the sum of each problem and prove your results by reverse addition.

a	*b*	*c*	*d*
3578.1329	721.001	1925.1926	21.98
821.098	9.1	1898.1001	666.625
43.11	85.48	7501.6145	3.7
6.9	2000.0002	3198.7152	21.0001
2.1	5243.8756	2000.1444	155.671
75.16	2978.3519	5053.2198	2198.1444
221.133	1795.2901	2222.1886	10.1

SUBTRACTION OF DECIMAL FRACTIONS

The purpose of subtracting one decimal fraction from another is to ascertain the difference between the two decimals. The process of subtraction in decimal fractions is the same as in whole numbers. Since the position of the decimal always determines the value of the fraction, it is necessary to have the decimal points under one another before subtracting.

The illustrations below show the solution of .487 subtracted from .5, and .5 subtracted from .787.

The solution at the left shows the process of subtraction when three figures are required to express the fraction to be taken from one which can be expressed with one number. The subtraction of 7 is from 10, 8 from 9, and 4 from 4 by the process of borrowing, or adding to 7 the number which will make 10. Ciphers could be added to the right of 5, but this is not necessary, since they may be assumed. In the process at the right, the value of the fraction to be subtracted is expressed in one figure, and the fraction from which it is to be subtracted, in three figures. Ciphers could be added to the right of the 5, but this is not necessary. The process is to bring down the figures in the hundredths and thousandths columns, and subtract the figures in the tenths column.

.5	.787
.487	.5
.013	.287

Keep in mind the fact that it is not possible to subtract a decimal fraction with a larger value from one with a smaller value, no more than it is possible to subtract a whole number with a larger value from a whole number with a smaller value.

EXERCISE No. 110, SUBTRACTION OF DECIMAL FRACTIONS

The following problems provide written practice in subtraction of decimal fractions. Show on tablet paper the solution of each problem in the same form as in the above illustrations.

1	2	3	4	5
a. .25	*a.* .2	*a.* .7	*a.* .2	*a.* .14449
.125	.0001	.699	.0221	.12315
b. .796	*b.* .5019	*b.* .001	*b.* .6374	*b.* .76852
.509	.0201	.0001	.3528	.49736
c. .7	*c.* .325	*c.* .9801	*c.* .0901	*c.* .21359
.235	.0475	.5766	.0176	.09078

EXERCISE No. 111, SUBTRACTION OF MIXED DECIMALS

The process of subtracting mixed decimals is the same as when subtracting decimal fractions. The decimal points must

be placed in a vertical line, with the whole number values on the left, and the fractional values on the right, of the decimal point. The difference must be arranged in the same manner.

The following problems provide practice in subtracting decimals. You will observe when mixed decimals are involved, the fraction in the subtrahend of the mixed decimal may be larger than the fraction in the minuend of the mixed decimal because it is possible to increase the value of the fraction by borrowing.

1	2	3	4
a. 1000.0001	*a.* 5138.7343	*a.* 256.303	*a.* 243.66
1.1	4917.9872	199.545	128.35
b. 2109.0098	*b.* 1774.1896	*b.* 405.001	*b.* 267.89
143.7786	296.0041	31.786	165.01
c. 8778.1561	*c.* 3149.9876	*c.* 443.687	*c.* 143.67
5489.3547	2214.7784	357.441	1.99

EXERCISE No. 112, SUBTRACTION OF MIXED NUMBERS

When the fractional value in one mixed number is expressed as a common fraction and in the other as a decimal fraction, it is necessary to express both values either as decimal fractions or as common fractions before subtracting. The nature of the problem will determine whether it is better to change the decimal to a common fraction or the common fraction to a decimal.

The following problems provide written practice in subtraction when both common and decimal fractions are involved. If both forms of the fraction are expressed, you may use your choice of changing the common fraction to a decimal, or the decimal fraction to a common fraction before subtracting. You will show on tablet paper all the calculations necessary to ascertain the desired answer and prove its correctness.

1	2	3
a. $\frac{3}{4} - .325$	*a.* $.9876 - \frac{9}{17}$	*a.* $24\frac{3}{8} - 18.244$
b. $\frac{9}{11} - .4465$	*b.* $.844 - \frac{9}{16}$	*b.* $63\frac{3}{8} - 52.4$
c. $\frac{7}{16} - .1716$	*c.* $.3444 - \frac{3}{41}$	*c.* $58.72\frac{1}{3} - 44.89\frac{4}{9}$
d. $\frac{12}{25} - .007$	*d.* $.9 - \frac{9}{13}$	*d.* $75.5\frac{3}{7} - 67.987\frac{1}{2}$
e. $\frac{21}{27} - .5$	*e.* $15\frac{3}{4} - 12.0055$	*e.* $4.567\frac{1}{2} - 2.999\frac{1}{9}$
f. $\frac{4}{8} - .125$	*f.* $36\frac{1}{3} - 24.97$	*f.* $28.093\frac{1}{5} - 25$

EXERCISE No. 113, REVIEW

The following problems provide a review of addition and subtraction of decimals. Show on tablet paper all the calculations necessary to arrive at the desired answer in each problem, and the proof of its correctness. If you can solve any of these problems without the use of the pencil, write the answer, and after it the letter "M" to indicate mental solution.

1. Add four and fifty-five ten-thousandths, seventy-five hundred-thousandths, one and sixteen hundredths, five thousand and one millionth.

2. From the sum obtained in problem 1 take the sum of the following: sixteen ten-thousandths, one and nine hundred fifteen ten-thousandths, and seven eighths of a hundred-thousandth.

3. Add 75 units, 75 tenths, 75 hundredths, 75 thousandths, and 75 ten-thousandths.

4. $\frac{3}{4}+\frac{7}{8}+\frac{2}{3}+1.6\frac{2}{3}+10\frac{1}{4}+37\frac{3}{8}+1.9+\frac{5}{8}+12\frac{3}{16}+2\frac{1}{8}=$.

5. Subtract $15.99\frac{1}{3}$ from 49.0016.

6. From $77.4\frac{1}{2}$ take $65.87\frac{1}{8}$.

7. From $3.45\frac{2}{5}$ take $2.99\frac{3}{4}$.

8. How much greater is $\frac{1}{2}$ of a tenth than $\frac{2}{3}$ of a hundredth?

9. How much more is nine and three fifths of a hundredth than six and two fifths of a tenth?

10. From 300 take 3 hundredths.

11. What is the sum of $9.45+.06\frac{2}{5}+5.6+4.16\frac{3}{4}+7.8\frac{1}{5}$?

12. Add $.24\frac{4}{5}$, $.1745\frac{3}{4}$, 46.5, and 38.0007.

13. $.3708+\frac{1}{2}+2.06\frac{2}{5}+\frac{3}{4}+.17\frac{3}{5}+.0\frac{1}{4}=$?

14. $81.26\frac{1}{2}+.046\frac{1}{2}+9.6\frac{2}{5}+76.7895\frac{3}{4}=$?

15. From $\frac{2}{3}$ of a tenth take $\frac{1}{2}$ of a hundredth.

16. To 19 hundredths add $\frac{2}{3}$ of a tenth.

17. What is the sum in decimals, of $3\frac{7}{8}$, $1\frac{2}{5}$, $5\frac{1}{2}$, $2\frac{3}{4}$?

18. Subtract $16\frac{1}{2}$ tenths from 4609 thousandths.

19. From $\frac{1}{18}$ of a hundredth take $\frac{5}{9}$ of a thousandth.

20. From $\frac{1}{5}$ of $\frac{1}{2}$ take .0925.

CHAPTER XII

DECIMALS (Continued)

MULTIPLICATION OF DECIMALS

The purpose of multiplication of decimal fractions is to ascertain the product of two decimals. The process of multiplication in decimal fractions is the same as in whole numbers, except it is necessary to take into consideration the fractional value of the product, and to indicate this by having as many figures at the right of the decimal point as there are figures at the right of the decimal points in both the multiplier and multiplicand.

.671	The solution at the left shows the process of multiplication of two decimals which have the same denominator, and the one at the right the multiplication of two decimals that have different denominators. You will observe the process of multiplication is the same as that in integers, and there must be as many figures at the right of the decimal point as there are in both the multiplier and multiplicand. When there are not enough figures in the product, sufficient ciphers must be prefixed to make the decimal places the same.	.047
.015		.35
3355		235
671		141
.010065		.01645

EXERCISE No. 114, MULTIPLICATION OF DECIMALS

The following problems provide written practice in the multiplication of decimal fractions. Show on tablet paper the solution of each problem in the same form as in the illustration above, and prove by reverse multiplication. Each problem requires two solutions: one showing the multiplier beneath the multiplicand; and the other, the multiplier above the multiplicand.

1	2	3
a. .0725 × .072	*a*. .3765 × .012	*a*. .009965 × .9
b. .0075 × .005	*b*. .7564 × .87	*b*. .009 × .008
c. .2653 × .325	*c*. .6562 × .598	*c*. .2009 × .675
d. .8642 × .967	*d*. .0083 × .7	*d*. .315 × .18

EXERCISE No. 115, MULTIPLICATION OF DECIMALS

The following problems provide practice in: (a) writing decimals; (b) multiplication of decimals; and (c) expressing the product in figures, and (d) in words.

1. Multiply six hundred seventy-five thousandths by seven hundredths.
2. Multiply seven thousand nine ten-thousandths by two thousandths.
3. Multiply three hundred twelve thousandths by fifty-seven hundredths.
4. Multiply sixty-seven hundredths by five thousandths.
5. Multiply four hundred fifty-four ten-thousandths by three hundred sixty-seven thousandths.
6. Multiply nine thousand nine hundred nine ten-thousandths by six ten-thousandths.
7. Multiply four hundred seventeen thousandths by twenty-nine hundredths.
8. Multiply one thousand four hundred forty-four ten-thousandths by five hundred nine thousandths.

EXERCISE No. 116, MULTIPLICATION OF INTEGERS AND DECIMALS

When it is desired to multiply a decimal fraction by an integer the process is the same as in multiplying two decimal fractions. The important element is to ascertain the number of decimal places in the product.

The following problems provide written practice in the multiplication of integers and decimals. Show on tablet paper all the calculations necessary: (a) to ascertain the product; and (b) to prove the product by reverse multiplication.

1	2	3
a. 4981 × .9009	*a*. 3374 × .1445	*a*. 1742 × .1492
b. 762 × .635	*b*. 225 × .13	*b*. 1883 × .005
c. 3774 × .1045	*c*. 6725 × .7631	*c*. 4752 × .367
d. 7 × .1673	*d*. 3456 × .33	*d*. 298 × .7

EXERCISE No. 117, MULTIPLICATION OF MIXED DECIMALS

When an integer and a decimal are involved in both the multiplier and multiplicand, the process is the same as when multiplying decimals or a decimal and a whole number.

The following problems provide written practice in multiplying mixed decimals. Show on tablet paper all the calculations necessary (a) to ascertain the product; and (b) to prove the product by reverse multiplication.

1	2	3
a. 9.887×100.6	*a.* 763.25×2214.6	*a.* 321.175×174.258
b. 35.42×625.8	*b.* 4356.2×329.43	*b.* 75.3908×214.432
c. 321.9×1.653	*c.* 55.424×1.2345	*c.* 625.107×4.00807
d. 277.3×14.25	*d.* 892.15×1007.1	*d.* 3675.42×275.314
e. 6.517×216.4	*e.* 56.432×1492.4	*e.* 1.00006×56.1472
f. 1.111×111.11	*f.* 1314.8×3.6	*f.* 36314.1×96.21
g. 313.1×8.136	*g.* 1912.6×11.83	*g.* 10009.2×83.161
h. 919.5×63.18	*h.* 1001.3×318.1	*h.* 1921.6×328.92

EXERCISE No. 118, BILLING

The multiplication of integers and fractions expressed decimally occur frequently in the extension of bills and inventories. The reason for this is because it is not always possible to express by integers the quantity of merchandise sold and the price.

The following problems provide practice in making extensions when the fractional values are expressed as decimals. You are to ascertain the correct amount of each sale which is the sum of the values of each item sold.

1. Brown Brothers, provision merchants, Buffalo, New York, sold J. C. Warren the following provisions:

20 pieces, 421 lbs., Bacon Sides	@	$.1375
25 Hams, 395½ lbs.,	@	.225
50 cans, 2500 lbs., Lard	@	.2175
5 sacks, 385 lbs., Dried Apples	@	.145

CAUTION: When decimal fractions are involved in the extensions of invoices, be sure to place the decimal point in either the multiplier, multiplicand, or both, before beginning the multiplication. Unless this plan is followed, there may be an error in placing the decimal point in the product. Thus, in extending the first item of the above invoice, there is no decimal point in the number of pounds, but there are four figures at the right of the decimal point in the price, hence there must be four figures at the right of the decimal point in the product.

2. W. E. Sutton & Company, Stock Brokers, sold the following stocks to W. O. Crosswhite, January 5:

25 shares, American Express	@	$136\frac{3}{4}$
35 shares, American Locomotive	@	$116\frac{1}{2}$
52 shares, American Radiator	@	$114\frac{1}{8}$
36 shares, American Smelting & Refining Co.,	@	$133\frac{1}{2}$
41 shares, Delaware-Lackawanna	@	$145\frac{3}{4}$
45 shares, Gulf States Steel	@	$90\frac{5}{8}$
15 shares, International Harvester	@	$128\frac{3}{4}$
32 shares, Union Pacific Ry.	@	$149\frac{7}{8}$
24 shares, U. S. Steel	@	$133\frac{7}{8}$

NOTE: The quotation on American Express means $136.75 per share, hence the value of 25 shares would be ascertained by multiplying $136.75 by 25. This will give a product of $3,418.75. The extensions of the other items are made in the same manner. Where the price is expressed in eighths, each eighth equals $12\frac{1}{2}$c.

3. The American Sugar Company sold the following items to J. B. Lipscomb, a retail grocer, 156 Walnut St., November 17:

5 bbls., 1,642 lbs., Granulated Sugar	@	$6.35 per cwt.
3 bbls., 917 lbs., Brown Sugar	@	5.95 per cwt.
25, 100 lb. bags, Granulated Sugar	@	7.05 per cwt.
25, 50 lb. bags, Granulated Sugar	@	7.07 per cwt.
10, 25 lb. sacks, Granulated Sugar	@	7.09 per cwt.
200 boxes Domino Sugar	@	.23 per box
50 boxes Powdered Sugar	@	.27 per box

4. The Hale Justis Wholesale Drug Co. sold the following items to The Corner Drug Store, June 6:

6 doz. bxs. Aspirin	@	$1.41
5 doz. bottles Witch Hazel	@	2.30
36 bxs. Talcum Powder	@	.18
20 jars Vaseline	@	$.11\frac{3}{4}$
8 doz. bxs. Zinc Stearate	@	1.80
24 bottles Rubbing Alcohol	@	$.52\frac{1}{2}$

EXERCISE No. 119, AUDITING INVENTORY

On December 31, the Peoples Grocery Company had in stock the merchandise given on the list below. You are to audit this inventory and show on tablet paper: (a) the calculations necessary to verify each extension; (b) errors in the extensions; (c) the corrected total

MERCHANDISE INVENTORY, DECEMBER 31, 19—

8	cases of Tag Soap	$4.75	$ 38		
7½	doz. LaCreme Mustard	1.75	13	13	
225	lbs. Corn Meal	.03½	7	85	
30	sacks Gold Medal Flour	1.45	43	50	
103	jars Preserves	.12½	12	88	
87½	doz. No. 2 Canned Peas	2.28¾	200	36	
275	pkgs. Brillo	.09¼	25	44	
8	kegs Herring	1.23½	19	92	
35¾	doz. cans of Peaches	2.75	99	31	
45½	lbs. Mixed Candy	.22½	10	24	
286½	lbs. Chocolate Creams	.15	43	98	
78	pkgs. Mello Wheat	.15	11	70	
325	lbs. Bokar Coffee	.55	178	75	
146	lbs. Santos Coffee	.33⅓	47	95	
248	lbs. 8 o'clock Coffee	.39	98	62	
986	lbs. Potatoes	.049	49	31	
216	lbs. Rome Beauty Apples	.055	12	85	
427	lbs. Leaf Lard, unrendered	.145	61	91	
46	lbs. Pork Sausage	.33	15	18	
36	doz. Tangerines	.35	12	75	
58	doz. Oranges	.40	24	20	
24	doz. Grapefruit	.98⅓	23	61	
18	lbs. Grapes	.15	3	70	
26½	doz. Strictly Fresh Eggs	.485	12	85	
24	lbs. Figs	.23	6	52	
10	lbs. Dates	.30	3	00	
50	bxs. Superior Salt	.04	2	00	
36	lbs. Nut Filled Dates	.225	8	10	
	Total				$1087 61

EXERCISE No. 120, COMPENSATION

Very often in business the compensation of a salesman is a definite number of cents on each dollar of the sales. When this is the case, it is necessary to multiply the sales by the number of cents, expressed decimally in hundredths, to find the compensation. The important element in such problems is the correct expression of the product by the decimal point.

The following problems provide practice in ascertaining the compensation of salesmen based on an agreed number of cents on each dollar of sales.

1. The Atlas Manufacturing Company employs twelve salesmen. Their compensation is a commission of $9\frac{1}{2}$c on each dollar of their sales. The sales made by each of the salesmen during the month of May were as follows:

a.	Davis.....	$2,604.65	*g.*	Older....	$3,152.40
b.	Malcolm....	2,732.55	*h.*	Curry...	2,318.85
c.	Jones.....	2,346.50	*i.*	Marx....	3,155.50
d.	Miller.....	2,541.95	*j.*	Mason...	2,242.75
e.	Roberts....	2,887.42	*k.*	Hardin..	2,714.40
f.	Kaufmann..	2,247.45	*l.*	Wilder...	2,127.58

You are to ascertain: (a) the amount of commission earned by each salesman; (b) the total sales; and (c) the total commission.

2. At the beginning of June, the sales manager agreed to allow those salesmen whose sales were larger than the average established in May, an extra cent commission on the sales in June above the May average. The sales in June were as follows:

a.	Davis.....	$2,648.25	*g.*	Older....	$2,968.42
b.	Malcolm...	2,832.47	*h.*	Curry...	2,472.28
c.	Jones.....	2,462.94	*i.*	Marx....	3,147.75
d.	Miller.....	2,645.31	*j.*	Mason...	2,537.68
e.	Roberts....	2,784.35	*k.*	Hardin..	2,674.32
f.	Kaufmann..	2,137.56	*l.*	Wilder...	2,243.49

You are to ascertain: (a) the amount of compensation received by each salesman; (b) the total compensation of the

twelve salesmen; and (c) the total sales made by all of the salesmen.

3. At the beginning of July, the sales manager agreed to give the salesmen the same rate of compensation as in June, but the bonus of one cent is to apply on the sales above the June average. The sales in July were as follows:

a. Davis.....	$2,742.50	*g.* Older.....	$2,687.48
b. Malcolm....	2,784.85	*h.* Curry.....	2,458.46
c. Jones.....	2,543.27	*i.* Marx.....	2,894.37
d. Miller.....	2,523.58	*j.* Mason.....	2,604.45
e. Roberts.....	2,957.29	*k.* Hardin.....	2,684.37
f. Kaufmann..	2,427.60	*l.* Wilder.....	2,420.75

You are to ascertain: (a) the amount of compensation received by each salesman; (b) the total compensation of the twelve salesmen; and (c) the total sales made by all of the salesmen.

DIVISION OF DECIMALS

The division of decimal fractions is for the same purpose as the division of common fraction and integers; that is, to ascertain the number of times one decimal fraction is contained in another decimal fraction. The process of division in decimal fractions is the same as in whole numbers, and common fractions, except it is necessary to take into consideration the fractional value of the quotient and to indicate this by having as many figures at the right of the decimal point as the number of decimal places in the dividend exceed those in the divisor. Thus, if the dividend has four figures at the right of the decimal point, and the divisor has one figure at the right of the decimal point, the quotient will have three figures at the right of the decimal point. When the decimal places in the divisor exceed those in the dividend, a sufficient number of ciphers should be annexed at the right of the decimal point to make those in the dividend and divisor equal. When all of the figures or ciphers in the dividend have been used through the process of division, additional ciphers may be annexed at the right of the dividend, and the process of division continued; the figures in the quotient after the ciphers are annexed will be at the right of the decimal point.

The illustration below shows the process of dividing .123 by .315 and .414 by .0375.

```
        .3904+
.315).1230000
       945
       ----
       2850
       2835
       ----
        1500
        1260
        ----
         240
```

The solution at the left shows the process of division with decimals which have the same denominator; the solution at the right, the division of two decimals which have a different denominator. The quotient contains as many decimal places as the number of decimal places in the dividend exceed the number in the divisor.

```
          11.04
.0375).414000
       375
       ---
        390
        375
        ---
         1500
         1500
         ----
```

EXERCISE No. 121, DIVISION OF DECIMALS

The following problems provide written practice in the division of decimal fractions. Show on tablet paper: (a) the quotient obtained in the same form as illustrated above; and (b) proof of the quotient by multiplication. If the division is not exact, annex ciphers to the dividend until three decimal places are obtained in the quotient.

1	2	3
a. .3544 ÷ .22	*a.* .21 ÷ .0007	*a.* .26 ÷ .0076
b. .2096 ÷ .04	*b.* .45 ÷ .1312	*b.* .2245 ÷ .17
c. .7853 ÷ .37	*c.* .63 ÷ .0021	*c.* .42 ÷ .0006
d. .4598 ÷ .55	*d.* .75 ÷ .0025	*d.* .75 ÷ .0015
e. .2778 ÷ .03	*e.* .98 ÷ .7743	*e.* .2216 ÷ .14
f. .4935 ÷ .21	*f.* .64 ÷ .3124	*f.* .7308 ÷ .63

EXERCISE No. 122, DIVISION OF DECIMALS

The following problems provide written practice in: (a) expressing, with figures, fractional values in decimal form; (b) division of one decimal by another; and (c) proof of division by multiplication. You are to show on tablet paper all calculations necessary to secure the desired quotient.

1. Twenty-six hundredths divided by forty-six thousandths.
2. Two thousand forty-four ten-thousandths divided by six hundred eight thousandths.
3. Five hundred eighty-six thousandths divided by forty-one hundredths.

4. Eight thousand nine hundred nine ten-thousandths divided by eight ten-thousandths.

5. Twenty-one hundredths divided by four hundred sixty-five thousandths.

6. Four hundred fifty-four ten-thousandths divided by sixty-five hundred-thousandths.

7. One hundred four millionths divided by three hundred thousandths.

8. Six hundred thirty-eight hundred-thousandths divided by sixty-five hundredths.

9. Six hundred twenty thousandths divided by forty-five ten-thousandths.

10. Three thousandths divided by twenty-seven ten-thousandths.

EXERCISE No. 123, DIVISION OF DECIMALS AND INTEGERS

When a problem requires the division of an integer by a decimal, or a decimal by an integer, the process is the same as in the division of decimals. The quotient must contain as many decimal places as those in the dividend exceed those in the divisor.

The following problems provide written practice in ascertaining the quotient resulting from the division of an integer by a decimal, or a decimal by an integer. Show on tablet paper (a) all of your calculations and (b) prove the quotient by multiplication. When the divisor is not contained in the dividend an equal number of times, the process of division should be continued until three decimal places are obtained in the quotient.

1	2	3
a. $7642 \div .21$	*a.* $.6875 \div 43$	*a.* $.4756 \div 1137$
b. $5375 \div .55$	*b.* $.3413 \div 13$	*b.* $.5837 \div 21137$
c. $9847 \div .87$	*c.* $.8009 \div 11$	*c.* $.6847 \div 458$
d. $6845 \div .34$	*d.* $.2754 \div 21$	*d.* $.9283 \div 302$
e. $2098 \div .64$	*e.* $.9834 \div 67$	*e.* $.5738 \div 4573$
f. $4753 \div .49$	*f.* $.9672 \div 56$	*f.* $.7843 \div 6009$

EXERCISE No. 124, DIVISION OF MIXED DECIMALS

When the problem requires the division of one mixed decimal by another the process of division is the same as when dividing a decimal fraction by a decimal fraction, or by an integer.

The following problems provide written practice in dividing mixed decimals. Arrange your work on tablet paper in the same form as illustrated in Exercise No. 120, and prove by multiplication.

1	2	3
a. 77.54 ÷ 21.42	*a.* 2781.4 ÷ 76.398	*a.* 276.259 ÷ 139.117
b. 2.980 ÷ 1.206	*b.* 879.35 ÷ 396.67	*b.* 9876.54 ÷ 25.7643
c. 355.6 ÷ 121.9	*c.* 43.006 ÷ 2.5467	*c.* 42.7108 ÷ 7.64371
d. 98.75 ÷ 567.3	*d.* 778.24 ÷ 221.16	*d.* 554.872 ÷ 23.1581
e. 443.7 ÷ 5.432	*e.* 9876.5 ÷ 33.489	*e.* 3724.05 ÷ 221.786
f. 0.009 ÷ 3.508	*f.* 67.309 ÷ 9.3274	*f.* 629.405 ÷ 321.456

EXERCISE No. 125, DIVISION OF MIXED DECIMALS

When the problem requires the division of a mixed decimal by an integer, or an integer by a mixed decimal, the process of division is the same as when dividing a decimal fraction by an integer, or by a decimal fraction. The important element is the proper location of the decimal in the quotient.

The following problems provide written practice in dividing an integer by a mixed decimal, and a mixed decimal by an integer. Arrange your work on tablet paper in the same form as illustrated in Exercise No. 120, and prove by multiplication.

1	2	3
a. 13.487 ÷ 367	*a.* 4877 ÷ 25.574	*a.* 643.14 ÷ 48374
b. 134.57 ÷ 32	*b.* 5869 ÷ 234.67	*b.* 374656 ÷ 23.46
c. 1283.6 ÷ 845	*c.* 5948 ÷ 4351.6	*c.* 23.473 ÷ 47362
d. 1.3785 ÷ 1389	*d.* 3945 ÷ 2.3875	*d.* 548.23 ÷ 47321
e. 14.675 ÷ 147	*e.* 1374 ÷ 23.463	*e.* 485712 ÷ 2.374
f. 123.75 ÷ 168	*f.* 2137 ÷ 574.46	*f.* 584731 ÷ 34.54

CHAPTER XIII

PRACTICAL PROBLEMS IN DECIMAL FRACTIONS

The purpose of these problems is to provide additional practice in the application of the four fundamental operations to problems involving decimal fractions, and in applying fractions to the solution of business problems. You are to show on tablet paper: (a) all your calculations necessary to ascertain the desired facts; and (b) proof of your calculations.

1. At the beginning of a ten day vacation trip the speedometer on J. F. Sherwood's car registered 9,647.8 miles. The mileage registered at the close of each of the ten days was as follows: 9,935.4; 10,191.8; 10,487.1; 10,792.8; 11,105.4; 11,401.9; 11,714.4; 11,989.7; 12,242.6; and 12,512.1. It is desired to know: (a) the distance traveled each day; (b) the total distance traveled; and (c) the average mileage each day.

2. During the ten days vacation trip mentioned in problem No. 1, Mr. Sherwood purchased gasoline as follows: first day, 15 gals. at 22½c and 15 gals. at 23c; second day, 15 gals. at 24½c; third day, 15 gals. at 22c and 15 gals. at 22½c; fourth day, 15 gals. at 23c and 15 gals. at 23½c; fifth day, 15 gals. at 23½c and 15 gals. at 22½c; sixth day, 15 gals. at 22½c and 15 gals. at 21½c; seventh day, 15 gals at 24c; eighth day, 15 gals. at 23c and 15 gals. at 22½c; ninth day, 15 gals. at 22½c and 15 gals. at 22c; tenth day, 15 gals. at 22½c and 15 gals. at 22c. It is desired to know: (a) the cost of the gasoline used on the trip; and (b) the number of miles per gallon, expressing the answer decimally in thousandths.

3. Reduce $\frac{7\frac{1}{2}}{30}$ to decimal form and divide by seventeen ten-thousandths.

4. A ton (2,000 lbs.) of ground feed contains 200 lbs. of flax seed, 250 lbs. corn, 750 lbs. barley, and the remainder is oats. Express the fractional part of each in decimal form.

5. The cost of manufacturing an order for 5,240 knives was $642.58. What was the cost in cents and thousandths of a cent per knife?

6. Multiply $408.06\frac{2}{3}$ by 75.125, and divide the product by 4.

7. The cost of manufacturing 6,500 spools was $4.29. What was the cost per spool?

8. On July 19, the Pittsburgh "Pirates" had won 55 games and lost 29. The New York "Giants" had won 52 games and lost 30. What were the League standings of the two Clubs? (Express in thousandths.)

9. If the "Giants" defeat the "Pirates" in the next two games, (a) which will be ahead; (b) how many thousandths?

10. From $7.03\frac{1}{3}$ subtract $4\frac{3}{3\frac{1}{2}}$.

11. The Mitchell Publishing Company of Chicago wishes to ship a quantity of books to San Francisco. Upon inquiry, the following rates are quoted: by rail direct from Chicago in a car load, minimum weight 30,000 lbs., $2.775 per cwt.; from Chicago to New York by rail, $0.945 per cwt.; and from New York to San Francisco by water, $0.90 per cwt. It is desired to know: (a) the freight cost on a car weighing 36,487 lbs. direct by rail; (b) by water and rail; and (c) the amount saved if the shipment is made by rail and water, and the marine insurance is $42.

12. The passenger fare from Cincinnati to Chicago is $14.01. The rate per mile is $0.036. It is desired to know the distance between these two cities expressed as a whole number, or as a mixed number with the fraction expressed decimally in hundredths.

13. Express decimally the difference between two hundred fifteen thousandths, and two hundred and fifteen thousandths.

14. U. B. Joy bought six United States bonds at $102\frac{5}{8}$ and sold them for $103\frac{1}{4}$. (a) How much did he make on the transaction? (b) What fractional part of the cost is the profit? Express your answer decimally in hundred-thousandths.

NOTE: $102\frac{5}{8}$ means $102.62\frac{1}{2}$.

15. From three hundred forty-six and two hundred five ten-thousandths, take three hundred forty-six ten-thousandths.

16. To $7.0852\frac{1}{3}$, add $\frac{1}{8}$ of it.

17. The distance between two cities is 477.68 miles. What is the cost of a railroad ticket at $3.60 per hundred miles?

18. Twenty-four hundredths of a farm was planted in corn. The yield was 48.4 bushels per acre, and was sold at 75c per bushel. If the corn crop was sold for $1,742.40, how many acres were there in the farm?

19. The freight rate on sugar between two cities is 79.27 cents per hundred pounds. What will be the freight cost on five barrels weighing as follows: 327 pounds, 339 pounds, 325 pounds, 342 pounds, and 336 pounds?

20. Find the cost of $27\frac{1}{2}$ lbs. of coal at $8.50 per ton of 2,000 lbs.

21. A restaurant had two cakes of equal size. No. 1 was cut into 12 pieces and sold at 20c a piece, and No. 2 was cut into 18 pieces and sold at 15c a piece. It is desired to know: (a) the fractional difference, expressed decimally, between the size of the pieces in the two cakes; (b) the difference between the selling price of the two cakes; (c) the fractional relation, expressed decimally, of this difference as compared with the selling price of cake No. 1; and (d) as compared with the selling price of cake No. 2.

22. Find (a) the value of the following items and (b) the total value.

a. 125 lbs. at $4 per hundred pounds

b. 20 lbs. at $0.035 per pound

c. 450 lbs. at $2.50 per hundred pounds

d. 14 yds. at $0.075 per yard

e. 40 bu. at $1.005 per bushel

f. 4.5 tons at $20 per ton

g. 3000 lbs. at $8.25 per thousand pounds

h. 15 gal. at $0.425 per gallon

i. 25 lbs. at $0.025 per pound

j. 2.5 bu. at $2.50 per bushel

23. The following problems provide written practice in addition. Speed can be acquired only through combinations as explained in Chapter II. Find the sum of each problem and prove your answers.

a	*b*	*c*	*d*	*e*
7,864,265	$4,540.75	2.3	763.445	78,641
2,217,682	7,168.21	7.9	1.008	2,344,098
3,496,572	59.33	99.67	27.9	4,776
4,210,710	2,914.45	71.43	898.26	54,304
5,796,423	349.66	473.561	43.756	9,103,725
5,021,349	1,009.75	592.298	9.22	6,251,428
1,127,534	5.25	312.001	75.36	375
8,210,396	2,210.16	575.761	417.683	291,743
1,404,507	327.41	67.09	7.06	7,824,325
9,817,654	9,201.37	37.51	28.34	209,804
2,256,341	2,176.51	8.1	567.202	8,341,829
3,914,673	86.10	5.4	4.017	5,950,763

24. The space occupied by each department of a factory was as follows:

Department A	4,700 square feet
Department B	6,100 square feet
Department C	8,300 square feet
Department D	9,500 square feet
Department E	4,600 square feet
Department F	5,800 square feet

The annual rent was $7,200. You are to ascertain: (a) the amount of annual rent allocated to each department; and (b) the amount charged to each department when the rent was paid on the first of each month.

25. C. M. Orr paid $60,000 for an eight-apartment building. His net income from the rent of this building at the end of the first year was .092 of the cost of the property. (a) How much was the net income? (b) What was the net monthly rent for each of the eight apartments?

26. James Dobson, a traveling salesman received $9\frac{3}{4}$c on each dollar and fraction thereof of sales which he made. In addition to that, he was compensated for his expenses in making the sales. During one year his sales were $89,462.75 and his expenses, $2,689.37. During that year his employers paid him $5,600. How much was due him at the end of the year?

27. A certain automobile company advertised that one of its models was driven from Washington, D. C. to Oakland, California, 3,127 miles, in 96 hours and 18 minutes. What was the average number of miles traveled per hour?

NOTE: Your answer should be shown as a mixed decimal with the fraction expressed in thousandths.

28. The present standing of the Champion Baseball Club is .875; of the Challengers .625. At the present time each club has played 48 games. If the Champions win only four out of the next twelve games, and the Challengers win eight out of the next twelve games, how will the clubs stand?

29. Divide forty-five hundredths by fifteen ten-thousandths.

30. The tariff rate on a certain commodity was .00225 of the import value. If the tariff (tax) amounted to $570, what was the total value of the product imported?

31. The following prices were quoted in a recent newspaper advertisement. You are to show (a) the saving in dollars and cents, (b) the fractional value of this saving based on the original sale price expressed as a decimal fraction, and (c) the total saving, in dollars and cents, to a customer who should buy one each of these articles.

a.	$ 15.00 dresses	$12.00	*k.*	$1.00 men's shirts	$0.80
b.	20.00 dresses	15.00	*l.*	1.25 men's shirts	1.00
c.	25.00 dresses	20.00	*m.*	1.50 men's shirts	1.20
d.	30.00 dresses	24.00	*n.*	2.00 men's shirts	1.50
e.	35.00 dresses	28.00	*o.*	2.50 men's shirts	1.80
f.	40.00 dresses	32.00	*p.*	3.00 men's shirts	2.25
g.	48.00 dresses	36.00	*q.*	.40 towels	$0.35
h.	60.00 dresses	40.00	*r.*	.48 towels	.40
i.	100.00 dresses	70.00	*s.*	.56 towels	.45
j.	125.00 dresses	90.00	*t.*	.75 towels	.60

32. The "Simplex" auto makes 255.5 miles on five gallons of oil, and the "Complex" makes 175.25 miles on three and a half gallons. What is the difference in distance per gallon, expressed in thousandths of a mile?

33. The Losey Novelty Company bought one gross of steel pens at five tenths of a cent each and sold them at the rate of eight for five cents. State the gain or loss decimally on each.

34. January 1, James Whitcomb received a statement from the bank showing a balance of $762.55 with check No. 44 for $12.65 (the last one written) unpaid. During the month of January, he wrote checks and made deposits as follows:

January 2	Check No. 45	$ 58.50
January 4	Check No. 46	17.44
January 5	Check No. 47	89.90
January 7	Check No. 48	48.16
January 8	Check No. 49	21.45
January 10	Check No. 50	37.50
January 10	Deposited	300.00
January 11	Check No. 51	75.00
January 12	Check No. 52	95.98
January 13	Check No. 53	100.00
January 14	Deposited	75.00
January 15	Check No. 54	35.61
January 17	Check No. 55	25.75
January 19	Check No. 56	36.67
January 20	Deposited	20.00
January 23	Check No. 57	8.95
January 26	Check No. 58	13.25
January 27	Deposited	35.00
January 28	Check No. 59	28.95
January 29	Check No. 60	13.55

February 1, the statement from the bank shows all checks have been paid with the exception of Check No. 60.

Show on tablet paper: (a) the bank balance after each check has been subtracted or deposit added; and (b) the balance shown by the monthly statement received from the bank.

35. If sugar sells at .075 per pound, how many pounds can you buy for $75.75?

36. Corn meal is advertised at a special sale, 12.25 lbs. for 62c. What is the cost per pound.

37. Three freight cars loaded with coal weighed respectively, 39.75 tons, 42.285 tons, and 40.72 tons. What was (a) the total weight and (b) the value at $6.75 per ton?

38. The information given below shows the value of the building permits issued in certain Ohio cities during October and November of the same year, and November of the previous year. It is desired to know, (a) the increase or decrease in each city of November over October, and (b) of November this year over November last year, and (c) the increase or decrease ascertained in (b) expressed decimally in thousandths.

	Nov. this Year	Nov. last Year	Oct. this Year
Akron	$ 707,848	$1,005,798	$1,547,273
Cleveland	6,575,075	4,330,800	6,045,350
Columbus	1,233,800	1,368,500	3,240,700
Dayton	462,296	576,359	580,100
Hamilton	148,897	106,465	154,459
Lima	101,795	167,305	64,320
Mansfield	124,480	122,775	153,050
Springfield	78,560	354,350	78,055
Toledo	1,462,282	902,597	1,486,644
Youngstown	330,000	1,221,050	3,464,630

39. Reduce to decimals and add: $\frac{5}{12}+\frac{5}{9}+\frac{3}{4}+\frac{1}{64}+\frac{2}{3}+\frac{7}{50}+\frac{1}{6}+1\frac{5}{8}$. Carry to four decimal places, expressing the remainders as common fractions.

40. A publishing company sold the following books during the year: January, 926; February, 842; March, 530; April, 285; May, 248; June, 196; July, 495; August, 1,548; September, 5,490; October, 4,560; November, 1,249; December, 539. Ascertain: (a) the total number of books sold during the year; (b) the average monthly sales; and (c) the number each month is above or below the average, indicating above by "+", and below by "−".

41. If the books mentioned in problem 40 were sold at $1.125 per copy, what was (a) the total sales for each month? (b) The total sales for the year?

42. The following problems provide practice in addition, subtraction, multiplication, and division. Complete the process in the order indicated by the sign. (a) Show the results of each horizontal column; and (b) add these totals and prove by reverse addition.

a. $4\times4-3\times2+6-4\times2-6\times2-4\div8-5\times2=$
b. $3\times6+9-7\div2+8\times2-6\times3\div2-5\div8+6=$
c. $7\times7-9\div4+6\times2-5\div9+7\times2-6\times2\div7=$
d. $6\times3\div9+6-2\times3+6\div2\times3-6\div3+4\div7=$
e. $5\times5-4\div7\times2+4\times2-6\div7+8\times3\div5\times4=$
f. $2\times9\div3+5\times2-6+4\div5+6\times3\div6+7+4=$
g. $5\times6\div3-4\times3\div9\times7+6-9\times2+6\div7\times4=$
h. $6\times2\div4\times6+9\div3-6\times5+6\div7\times4-4\times3=$
i. $5\times9\div3-5+9\times2-8\div3\times2-7-3\times2\div8=$
j. $2\times9\div6+4\times2-4\div5\times9+6\div8\times6-8+6=$

43. The limited telephone service in a certain office is charged at the rate of $3.50 per month with an additional charge of five cents per telephone call on all calls exceeding fifty calls per month. During the month of February, ninety-seven calls were made. What was the amount of the February telephone bill?

44. The following facts were published by Farm Paper No. 1 for the information of its advertisers and as evidence of its value as an advertising medium:

	Paper No. 1 Lines	Paper No. 2 Lines	Paper No. 3 Lines	Paper No. 4 Lines	Paper No. 5 Lines	Paper No. 6 Lines
Farm implements and machinery	9,194	3,277	2,475	1,551	806	783
Nursery stock, seeds, etc.	5,427	2,969	2,716	380	1,969	1,251
Poultry feeds, remedies and supplies	4,496	2,312	2,128	1,239	1,012	860
Light plants, heating and water systems and equipment	2,643	1,555	656	446	347	227

You are to ascertain (a) the total number of lines of advertising in each of the six papers, and (b) the excess of the number of lines in Farm Paper No. 1 over each of the other five Farm Papers.

45. The table below shows the cost of operating the various departments of the United States Government for two consecutive years. You are to ascertain (a) the total expenses for each year, (b) the increase of one year over the other year, and (c) the amount of this increase expressed decimally in ten-thousandths.

	1st Year	2d Year
Legislative establishment	$ 14,915,001	$ 16,498,384
Executive office	489,960	441,960
Independent Offices—		
Civil Service Commission	1,008,092	1,001,592
Employes' Compensation Commission	2,301,500	2,742,040
Federal Board of Vocational Education	8,227,000	8,210,620
Federal Trade Commission	1,008,000	997,000
General Accounting Office	3,701,960	3,714,400
Housing Corporation	743,915	674,398
Interstate Commerce Commission	6,853,962	6,033,309
Public Buildings and Public Parks	2,282,505	2,293,850
Tariff Commission	721,500	699,000
Shipping Board and Emergency Fleet	24,330,000	14,198,574
Smithsonian Institution and National Museum,	874,020	858,240
United States Veterans' Bureau	405,700,000	458,965,000
Other independent offices	1,578,045	4,879,876
Department of Agriculture	133,075,191	140,717,758
Department of Commerce	28,542,129	30,402,847
Department of the Interior	262,255,603	250,967,602
Department of Justice	24,205,822	24,367,627
Department of Labor	8,627,625	8,567,305
Navy Department	302,862,378	322,869,430
State Department	16,277,652	16,614,932
Treasury Department	153,708,404	157,563,713
War Department, including Panama Canal	339,765,931	335,641,525
District of Columbia	36,032,853	35,626,579

46. L. B. Reid purchased five $1,000 bonds of the Inland Steel Company for $97\frac{3}{4}$ and sold them for $99\frac{3}{8}$. You are to ascertain: (a) the total amount paid for the bonds; (b) the amount received for them; (c) the profit; and (d) the profit expressed decimally in thousandths.

NOTE: "$97\frac{3}{4}$" means $\$97\frac{3}{4}$ on each $100 of the bond or $977.50 per bond.

47. James Brown purchased an automobile on the deferred payment plan. The cost price of the automobile was $1,680; the insurance, $44; and the extras, $120. He is to pay cash for the insurance, the extras, and four tenths of the cost price of the machine. The balance of the cost, plus the carrying charge of $180 is to be paid in twelve equal installments payable monthly. You are to ascertain: (a) the amount of cash paid; (b) the amount of each monthly payment; and (c) the total cost of the automobile when the twelve installments have been paid.

48. After using the automobile mentioned in the above problem for two years, Mr. Brown exchanged it for a new one, and was allowed an exchange value of $750. You are to ascertain: (a) the total loss resulting from this exchange; and (b) the average monthly loss of operating the automobile.

49. On a certain day the market price of the English pound expressed in dollars was $4.7865. Ascertain (a) the cost of a draft for 235 pounds and 5 shillings; and (b) the difference between this and the par value which is $4.8665.

NOTE: 20 shillings make a pound.

50. The distance between Los Angeles and San Francisco is 475 miles. What is the cost of a ticket at $.036 per mile?

CHAPTER XIV

ALIQUOT PARTS

An integer or mixed number which is contained in another number without a remainder is known as an *aliquot part* of that number. Three is an aliquot part of six, because it is contained in six without a remainder. Two and one half is an aliquot part of five, because it is contained in five without a remainder.

The aliquot parts of one hundred may be used to advantage in the multiplication of numbers when dollars and cents are involved. Thus, if the price of an article is $16\frac{2}{3}$c and the number of articles involved is 63, the value of the 63 articles can be ascertained by multiplying 63 by $16\frac{2}{3}$c or dividing 63 by 6. The solutions below show the application of both methods.

63	
.16⅔	
42	
378	
63	
$10.50	

The solution at the left shows the process when multiplication is used. The first amount, 42, is the product of $\frac{2}{3}\times 63$; the second amount is 6×63; and the third amount is 1×63. Two places are pointed off in the product, because of the two decimal places in the multiplier.

The solution at the right shows the process when 63 is divided by 6. Six is contained in 63 ten times with a remainder of 3; into 30 five times with no remainder, hence the result of dividing 63 by 6 is ten and fifty hundredths, or $10.50.

6)63.00
$ 10.50

The process of reasoning when applying aliquot parts to the solution of this problem would be as follows: if the price is $16\frac{2}{3}$c for one article, six articles could be purchased for $1 because $16\frac{2}{3}$ is $\frac{1}{6}$ of a dollar; if the price of each article were a dollar, the total cost of 63 articles would be $63, but since the price is only $\frac{1}{6}$ of a dollar. the total cost would be $\frac{1}{6}$ of $63 or $10.50.

EXERCISE No. 126, ALIQUOT PARTS

The problems on page 170 provide oral practice in ascertaining the value of a given number of articles when the price is an aliquot part of a dollar. The aliquot parts of a dollar most frequently used are shown in the second column of the table on page 171.

1	2
a. 9 bu. oats at 33⅓c	*a.* 48# apples at 8⅓c
b. 24#* sugar at 6¼c	*b.* 56# beans at 12½c
c. 120# candy at 16⅔c	*c.* 60 doz. eggs at 33⅓c
d. 32# lard at 12½c	*d.* 96 doz. eggs at 33⅓c
e. 22# tea at 50c	*e.* 48 yds. cloth at 12½c
f. 24 doz. eggs at 50c	*f.* 84# sugar at 8⅓c
g. 32 yds. ribbon at 33⅓c	*g.* 720 yds. ribbon at 25c
h. 45# bacon at 12½c	*h.* 75 gals. oil at 20c
i. 84# butter at 33⅓c	*i.* 114# soap at 16⅔c
j. 75 gals. oil at 16⅔c	*j.* 15 gals. gas at 33⅓c
k. 720# bacon at 25c	*k.* 55# lard at 20c
l. 96# sugar at 10c	*l.* 60 gals. cider at 50c

*NOTE: When the symbol "#" is placed after figures, it is interpreted as lbs.; when placed before figures, it is interpreted as No.

EXERCISE No. 127, ALIQUOT PARTS

If the quantity is an aliquot part of one hundred, or the price is an aliquot part of a dollar, the process of division may be applied just the same. Thus, the cost of 50 pounds at 27c per pound would be 27 divided by 2 or $13.50, just the same as 27 pounds at 50c would be $13.50.

The following problems provide additional oral practice in aliquot parts, when the price is an aliquot part of a dollar, or the quantity is an aliquot part of 100.

1	2	3
a. 25 gals. at 28c	*a.* 42 gals. at 25c	*a.* 28 doz. at 33⅓c
b. 28 gals. at 25c	*b.* 56# at 12½c	*b.* 12½ doz. at 28c
c. 33⅓# at 18c	*c.* 12½ hrs. at $1.20	*c.* 42 yds. at 20c
d. 96# at 8⅓c	*d.* 50 hrs. at $1.20	*d.* 20 yds. at 45c
e. 75 hrs. at 50c	*e.* 36 gals. at 33⅓c	*e.* 51 bu. at 33⅓c
f. 39 yds. at 33⅓c	*f.* 99# at 16⅔c	*f.* 25 gals. at 80c
g. 66 yds. at 12½c	*g.* 59 bu. at 50c	*g.* 81# at 16⅔c
h. 25 gals. at 42c	*h.* 50 gals. at 44c	*h.* 64# at 33⅓c

TABLE OF ALIQUOT PARTS

$1.00	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
2	.50														
3	.33⅓	.66⅔													
4	.25	.50	.75												
5	.20	.40	.60	.80											
6	.16⅔	.33⅓	.50	.66⅔	.83⅓										
8	.12½	.25	.37½	.50	.62½	.75	.87½								
10	.10	.20	.30	.40	.50	.60	.70	.80	.90						
12	.08⅓	.16⅔	.25	.33⅓	.41⅔	.50	.58⅓	.66⅔	.75	.83⅓	.91⅔				
16	.06¼	.12½	.18¾	.25	.31¼	.37½	.43¾	.50	.56¼	.62½	.68¾	.75	.81¼	.87½	.93¾

The table above shows the aliquot parts of a dollar and of a hundred, and the multiples of these aliquot parts. The numbers in the first vertical column indicate the denominators of the fractions representing the aliquot parts of a dollar, and the numbers at the top in the horizontal column, the numerators of the fractions representing the multiples of these aliquot parts. The aliquot parts of a dollar or a hundred are shown in the square where the two columns meet. 50c is ½ of a dollar; 33⅓c is ⅓ of a dollar; 66⅔c is twice 33⅓c, hence is a multiple of the aliquot part, 33⅓c. 25c is ¼ of a dollar, and 50c and 75c are both multiples of 25c. 20c is an aliquot part of a dollar, and 40c, 60c, and 80c are multiples of this aliquot part.

EXERCISE No. 128, MULTIPLES OF ALIQUOT PARTS

When the price of an article is a multiple of an aliquot part, the value of a given number of articles is ascertained by dividing the quantity by the denominator of the fraction representing the aliquot part, and multiplying the quotient by the numerator of the fraction representing the multiple of the aliquot part. If the quantity is an aliquot part of 100, the same principle will apply to the price.

If it is desired to ascertain the value of 48 articles at 37½c each, divide 48 by 8 and multiply by 3: $48 \div 8 = 6$; $6 \times 3 = 18$; when the aliquot part is of $1.00, this product, 18, is $18.00.

The problems at the top of page 172 provide oral practice in applying the information given in the table. The results are the same whether you divide and multiply, or multiply and divide.

1	2	3
a. 48 bu. at 75c	*a.* 48 gals. at 41⅔c	*a.* 50 gals. at 75c
b. 32 lbs. at 62½c	*b.* 54 bu. at 83⅓c	*b.* 98 doz. at 37½c
c. 96 bu. at 91⅔c	*c.* 85 yds. at 40c	*c.* 96 gals. at 18¾c
d. 64 gals. at 87½c	*d.* 50 bu. at 65c	*d.* 66 gals. at 41⅔c
e. 45 yds. at 80c	*e.* 75 gals. at 24c	*e.* 88 gals. at 87½c
f. 128 lbs. at 81¼c	*f.* 83⅓ yds. at 48c	*f.* 105 lbs. at 60c
g. 55 gals. at 40c	*g.* 96 bu. at 91⅔c	*g.* 75 lbs. at 25c
h. 72 bu. at 75c	*h.* 45 yds. at 40c	*h.* 25 gals. at 50c

EXERCISE No. 129, MULTIPLES OF ALIQUOT PARTS

The following problems provide written practice in applying multiples of aliquot parts. Show on tablet paper: (a) the value of the one aliquot part by division; and (b) the value of the required multiple by multiplication. Refer to the table and find the multiple as instructed in the oral exercise; when the divisor is not contained an equal number of times, multiply first and divide the product. Think twice before placing the decimal point.

1	2	3
a. 376 yds. at 75c	*a.* 516.8# at 62½c	*a.* 16.25 bu. at 87½c
b. 529 gals. at 18¾c	*b.* 6,875# at 25c	*b.* 481 yds. at 31¼c
c. 756 gals. at 83⅓c	*c.* 91.6 bu. at 68¾c	*c.* 2,265.75gals.at 83⅓c
d. 1,236# at 30c	*d.* 9,672.75# at 18¾c	*d.* 15.75 bu. at 93¾c
e. 3,264 bu. at 43¾c	*e.* 762.5 doz. at 83⅓c	*e.* 742.5 doz. at 37½c
f. 9,782.5# at 31¼c	*f.* 275.5 doz. at 31¼c	*f.* 37½ doz. at 42c
g. 421.75# at 40c	*g.* 762 bu. at 75c	*g.* 62½ bu. at 97c
h. 99.6 bu. at 56¼c	*h.* 9,964.75# at 91⅔c	*h.* 81¼ gal. at 23c

EXERCISE No. 130, MULTIPLES OF ALIQUOT PARTS

When the price is more than $1.00, or the quantity more than 100, and the excess of $1.00 or 100 is an aliquot part or a multiple of an aliquot part, the product may be found by dividing and multiplying in the same manner as when they are less than $1.00 or 100. Thus, if the price is $1.37½, divide the quantity by 8, and multiply by 3 plus 8, or 11. In other words, the price is $\frac{8}{8}$ of a dollar plus $\frac{3}{8}$ of a dollar.

The following problems provide written practice in applying aliquot parts, and multiples of aliquot parts.

1	2
a. 7,261 lbs. at $1.33\frac{1}{3}$	*a.* 768 bu. at $1.12\frac{1}{2}$
b. $127\frac{1}{2}$ bu. at $1.12\frac{1}{2}$	*b.* 22.05 gals. at $1.37\frac{1}{2}$
c. 81.25 lbs. at 32c	*c.* $214\frac{1}{2}$ lbs. at $18\frac{3}{4}$c
d. 45 doz. at $1.87\frac{1}{2}$	*d.* 516.75 bu. at $1.16\frac{2}{3}$
e. $227\frac{1}{2}$ bu. at $1.62\frac{1}{2}$	*e.* 271.5 bu. at $87\frac{1}{2}$c
f. $387\frac{1}{2}$ lbs. at $18\frac{3}{4}$c	*f.* 621.25 lbs. at $1.08\frac{1}{3}$
g. $75\frac{3}{4}$ doz. at $1.75	*g.* 217.5 bu. at $1.06\frac{1}{4}$
h. 427.05 bu. at $1.30	*h.* 79 gals. at $1.83\frac{1}{3}$
i. 55.25 gals. at $58\frac{1}{3}$c	*i.* $177\frac{1}{2}$ doz. at $43\frac{3}{4}$c
j. 216.5 bu. at $1.41\frac{2}{3}$	*j.* 991 bu. at $1.06\frac{1}{4}$

EXERCISE No. 131, BILLING

Aliquot parts are used to advantage in billing and extending the value of merchandise on inventories. The application is the same as in the preceding exercises.

The following problems provide written practice in making extensions of bills rendered.

Show all the calculations necessary to arrive at: (a) extension of each item; and (b) the total amount of the bill.

1. The Johnson Paper Company sold the Krehbiel Printing Company the following merchandise:

112,500 envelopes at $1.20 per thousand
14,765# of Regal Bond paper at $12\frac{1}{2}$c per pound
2,500# of ledger paper at $41\frac{2}{3}$c per pound
6,580# of news paper at $6\frac{1}{4}$c per pound
5,407# Crown book paper at $8\frac{1}{3}$c per pound
2,586# of Champion Coated paper at $16\frac{2}{3}$c per pound
3,175# of Old Hampshire paper at $41\frac{2}{3}$c per pound
1,250 Columbian Clasp envelopes at $2.12\frac{1}{2}$ per thousand
5,500 XXX white envelopes at $1.68\frac{3}{4}$ per thousand

2. February 1, the Kroger Grocery Company, dealers in wholesale groceries, sold H. M. Jameson, a retail grocer, the following merchandise:

3 sacks (300 lbs.) granulated sugar at $8\frac{1}{3}$c per pound
25 doz. Red Cross soap at 55c per dozen
32 doz. Canned peaches at $\$1.12\frac{1}{2}$ per dozen
75 doz. Canned apples at $\$1.06\frac{1}{4}$ per dozen
135 lbs. of rice at $8\frac{1}{3}$c per pound
$118\frac{3}{4}$ lbs. of coffee at 56c per pound

3. May 6, the Shillito Dry Goods Company sold Jenkins Bros., retail dry goods merchants, the following bill of goods:

18 yds. of flannel at $\$2.91\frac{2}{3}$ per yard
$66\frac{2}{3}$ yds. of black satin at $3.90 per yard
24 yds. of ribbon at $6\frac{1}{4}$c per yard
12 yds. of muslin at $16\frac{2}{3}$c per yard
16 yds. of gingham at $18\frac{3}{4}$c per yard
9 pairs of white hose at $\$1.33\frac{1}{3}$ per pair
12 cards of buttons at $12\frac{1}{2}$c per card

4. The Dow Drug Company had the following merchandise in stock on December 31. You are to show all the calculations necessary to verify (a) the extensions, and (b) the total value of the merchandise in stock.

488 tubes of Ipana tooth paste @ $37\frac{1}{2}$c	$183.00
360 tubes Pebeco tooth paste @ 30c	10.80
356 tubes Forhan's tooth paste @ 25c	89.00
246 tubes of Squibb's tooth paste @ $33\frac{1}{3}$c	8.20
366 tubes of Kolynos tooth paste @ $16\frac{2}{3}$c	68.00
288 bottles of toilet water @ $41\frac{2}{3}$c	120.00
112 boxes of Woodbury's soap @ $43\frac{3}{4}$c	490.00
128 boxes of Packer's tar soap @ $43\frac{3}{4}$c	56.00
128 boxes of Castile soap @ $18\frac{3}{4}$c	24.00
363 bottles of Honey and Almond Cream @ $33\frac{1}{3}$c	123.00
328 boxes of talcum @ $12\frac{1}{2}$c	41.00
128 bottles of Palmolive shampoo @ 25c	46.00
320 bars of Armour's bath soap @ $6\frac{1}{4}$c	40.00

APPLICATION OF ALIQUOT PARTS

Corn, wheat and other grain are listed on the grain exchanges at a price per bushel, but when delivered, the quantity is usually expressed in pounds, because it is not possible to provide containers holding an even number of bushels. When the price is per bushel, and the quantity expressed in pounds, there are three methods of ascertaining the value of a given quantity: (a) by dividing the quantity by the number of pounds in a bushel, and multiplying by the price per bushel; (b) by multiplying the number of pounds by the price per bushel and dividing by the number of pounds in a bushel; and (c) by multiplying the number of pounds by a fraction in which the numerator is the price per bushel, and the denominator the number of pounds in a bushel. The illustrations below show the three methods of ascertaining the value of 4,704 pounds of corn at 72c per bushel of 56 pounds.

a. $4704 \div 56 = 84$
$84 \times .72 = 60.48$
$60.48 = \$60.48$

b. $4704 \times .72 = 3386.88$
$3386.88 \div 56 = 60.48$
$60.48 = \$60.48$

c. $\frac{72}{56} = \frac{9}{7}$
672
$\cancel{4704} \times \frac{9}{\cancel{7}} = 6048$
$6048 = \$60\ 48$

In the problem given, the quantity can be expressed as an even number of bushels, hence solution (a) would be the most satisfactory. If the number of pounds had not been an even number of bushels, the fraction would have made the calculations more complicated. In solution (b) it is assumed that the price is per pound, hence the total number of pounds is multiplied by the price, then the product is divided by 56, the number of pounds in a bushel. In solution (c) the price per bushel is used as the numerator of a fraction, the denominator of which is the number of pounds in a bushel. This fraction is reduced to its lowest terms. Solution (c) is the most satisfactory when the price and the number of pounds have factors in common, so the fraction may be reduced to lower terms.

EXERCISE No. 132, APPLICATION OF ALIQUOT PARTS

The problems at the top of page 176 provide written practice in ascertaining the value of corn, using the method explained above. Show on tablet paper, using one of the three methods illustrated above, all the calculations necessary to ascertain the value of the given quantity at the price stated in each problem. The figures in the first column indicate the number of pounds of corn purchased; the amount in the second column show the price per bushel of 56 pounds.

1			2		
a. 5,159#	at	$0.64	*a.* 84,000#	at	$0.84
b. 2,144#	"	.63	*b.* 91,562#	"	1.05
c. 5,004#	"	.84	*c.* 17,642#	"	1.12
d. 1,008#	"	.49	*d.* 11,200#	"	.88
e. 9,884#	"	.48	*e.* 98,000#	"	.91
f. 8,010#	"	.76	*f.* 28,000#	"	.84
g. 4,800#	"	.77	*g.* 72,568#	"	.56
h. 5,901#	"	.88	*h.* 66,480#	"	.77
i. 5,146#	"	.56	*i.* 56,700#	"	.70
j. 3,988#	"	98	*j.* 98,000#	"	1.05

EXERCISE No. 133, APPLICATION OF ALIQUOT PARTS

The following problems provide written practice in ascertaining the value of wheat when the price is per bushel of sixty pounds.

1			2		
a. 6,475#	at	$1.32	*a.* 98,576#	at	$0.90
b. 3,781#	"	1.20	*b.* 17,645#	"	1.08
c. 5,650#	"	1.26	*c.* 86,664#	"	.75
d. 9,864#	"	1.30	*d.* 56,878#	"	1.50
e. 7,500#	"	1.08	*e.* 24,000#	"	1.10
f. 2,400#	"	.96	*f.* 99,960#	"	1.26
g. 9,996#	"	1.25	*g.* 20,000#	"	1.05
h. 7,884#	"	1.10	*h.* 72,000#	"	1.32
i. 9,964#	"	1.05	*i.* 11,164#	"	1.10
j. 7,765#	"	.96	*j.* 67,566#	"	1.35

EXERCISE No. 134, APPLICATION OF ALIQUOT PARTS

As explained in Exercise No. 128 multiples of aliquot parts may be used to an advantage when extending an invoice where these multiples are involved. These occur quite frequently in ascertaining the value of grain. When the quantity is stated in pounds and the price per bushel is a multiple of an aliquot part

of the number of pounds in a bushel, the value can be ascertained by multiplying the number of pounds by the fraction representing this multiple.

Thus if it is desired to ascertain the value of 862 pounds of oats at 48c per bushel the process would be as follows: $862 \times \frac{48}{32} = 862 \times \frac{3}{2} = \frac{2586}{2} = \$12.93$. A bushel of oats weighs 32 pounds hence, one half of a bushel is 16 pounds. 16 is an aliquot part of 32 also of 48.

The following problems provide written practice in the use of multiples of aliquot parts in ascertaining the value of oats with 32 pounds to a bushel. The quantity is given in the first column, and the price per bushel in the second column. Show on tablet paper the solution of each problem in the same form as in the illustration.

	1			2	
a. 7,846#	at	$0.80	*a.* 74,000#	at	$1.12
b. 2,568#	"	.36	*b.* 96,468#	"	1.04
c. 3,894#	"	.48	*c.* 20,468#	"	.64
d. 8,760#	"	.64	*d.* 11,676#	"	.88
e. 7,400#	"	.40	*e.* 29,684#	"	1.32
f. 2,696#	"	.56	*f.* 67,856#	"	.68
g. 9,896#	"	.68	*g.* 39,568#	"	1.00
h. 5,672#	"	1.04	*h.* 87,652#	"	.72
i. 3,784#	"	.48	*i.* 54,800#	"	.36
j. 6,392#	"	.72	*j.* 20,000#	"	.56

NOTE: The aliquot parts of a bushel used to the best advantage are: 4 lbs. $= \frac{1}{8}$; 8 lbs. $= \frac{1}{4}$; 16 lbs. $= \frac{1}{2}$.

EXERCISE No. 135, APPLICATION OF ALIQUOT PARTS

Logs are sawed into lumber in pieces with the desired length, width, and thickness, and sold at a price per thousand board feet. When the quantity or the price is an aliquot part, or a multiple of an aliquot part of a thousand board feet, the price may be ascertained by multiplying by a fraction, the same as in grain. Thus, if it is desired to ascertain the value of 750 feet of lumber at $36 per thousand, the value may be ascertained by using 750 as the numerator of a fraction and 1,000 as the denom-

inator. This reduced to its lowest terms is $\frac{3}{4}$. The price per thousand, \$36, is then multiplied by $\frac{3}{4}$, giving a product of \$27, which is the price of 750 feet.

The following problems provide written practice in ascertaining the value of a given quantity of lumber expressed in board feet with the price per thousand board feet. You are to show on tablet paper all the calculations necessary to ascertain the desired information using the aliquot parts of one thousand.

1	2
a. 1,500 ft. at \$45.00 per 1000	*a.* 625 ft. at \$55.50 per 1000
b. 3,000 " " 48.00 " "	*b.* 875 " " 52.25 " "
c. 4,500 " " 52.00 " "	*c.* 1,125 " " 44.00 " "
d. 4,250 " " 38.75 " "	*d.* 625 " " 72.50 " "
e. 7,500 " " 42.50 " "	*e.* 1,625 " " 54.50 " "
f. 2,500 " " 65.00 " "	*f.* 2,125 " " 21.50 " "
g. 12,500 " " 45.50 " "	*g.* 4,250 " " 42.50 " "
h. 750 " " 41.50 " "	*h.* 1,750 " " 75.00 " "
i. 1,2655 " " 100.00 " "	*i.* 1,250 " " 55.25 " "
j. 125 " " 38.50 " "	*j.* 6,288 " " 50.00 " "

NOTE: The aliquot parts of a thousand used to the best advantage are: 125 ft. = $\frac{1}{8}$; 250 ft. = $\frac{1}{4}$; 500 ft. = $\frac{1}{2}$.

EXERCISE No. 136, APPLICATION OF ALIQUOT PARTS

When the price is per ton of 2,000 pounds, and the quantity given in pounds, the number of pounds may be divided by 2,000 to ascertain the number of tons, and the number of tons multiplied by the price. If the number of pounds given is not an even number of tons, consider the remainder as the numerator of a fraction with 2,000 as the denominator. Multiply the price by this fraction to ascertain the value of the fractional part of a ton. If the entire quantity is more than a ton, this may be expressed as an improper fraction with the total number of pounds as the numerator, and 2,000 as the denominator. Multiply the price by the improper fraction, reduced to its lowest terms. The result will be the total cost. When the price per ton is expressed in dollars and cents, it is necessary to point off five places in the product; if the price is stated in dollars only, three places are pointed off in the product.

The following problems provide written practice in ascertaining the value of merchandise when the quantity is expressed in pounds and the price is per ton of 2,000 pounds. You are to show on tablet paper all the calculations necessary to arrive at the desired information using the aliquot parts of 2,000.

1					2				
a.	1,500	lbs. of	hay	at $22.50	*a.*	8,750	lbs. of	coal	at $ 5.25
b.	2,500	" "	coal	" 7.25	*b.*	9,750	" "	pig iron	13.95
c.	800	" "	hay	" 24.50	*c.*	8,020	" "	hay	at 22.00
d.	12,250	" "	steel	" 19.50	*d.*	4,200	" "	coal	" 6.00
e.	2,500	" "	coal	" 5.50	*e.*	8,964	" "	pig iron	12.50
f.	5,000	" "	pig iron	14.50	*f.*	75	" "	coal	at 6.00
g.	1,750	" "	hay	at 24.00	*g.*	8,562	" "	hay	" 25.00
h.	7,500	" "	steel	" 22.50	*h.*	150	" "	hay	" 20.00
i.	87	" "	hay	" 20.00	*i.*	8,764	" "	steel	" 25.00
j.	2,250	" "	hay	" 25.50	*j.*	17,500	" "	pig iron	13.50

NOTE: The aliquot parts of a ton used to best advantage are 125 lbs. = $\frac{1}{16}$; 200 lbs. = $\frac{1}{10}$; 250 lbs. = $\frac{1}{8}$; 500 lbs. = $\frac{1}{4}$.

EXERCISE No. 137, ALIQUOT PARTS

Aliquot parts or multiples of aliquot parts can be used to an advantage whether they are involved in the quantity or price. Thus the value of 60 pounds of wheat at 85c per bushel of 60 pounds, may be ascertained by the same process as the value of 85 pounds of wheat at 60c per bushel of 60 pounds. You should learn to utilize aliquot parts and multiples of aliquot parts in all possible calculations, because their use will enable you to solve a problem more quickly.

The following problems provide oral practice in aliquot parts and multiples of aliquot parts as discussed in the preceding exercises.

1. 90 lbs. of wheat at $1.10 per bu.
2. 90 bushels of oats at 33$\frac{1}{3}$c per bushel.
3. 250 ft. of lumber at $44 per M.
4. 168 ft. of lumber at $25 per M.
5. 88 lbs. of corn at 63c per bu. of 56 lbs.
6. 120 yds. of ribbon at 8$\frac{1}{3}$c per yd.

7. 30 yds. of tape at $3\frac{1}{3}$c per yd.
8. 12 quarts of plums at 25c per quart.
9. 96 lbs. of hay at $25 per ton.
10. 125 lbs. hay at $24 per ton.
11. 128 lbs. coal at $5 per ton.
12. 24 lbs. of butter at $37\frac{1}{2}$c per lb.
13. 80 bu. of barley at 75c per bu.
14. 820 pounds of tobacco at $12\frac{1}{2}$c per lb.
15. 40 bushels of corn at $87\frac{1}{2}$c per bushel.
16. What will be the cost of 86 lbs. of green apples at $2.50 per bu. of 50 lbs.?
17. What will 96 lbs. of barley cost at 80c per bu. of 48 lbs.?
18. How much will 63 lbs. of buckwheat cost at 90c per bu. of 42 lbs.?
19. What will 96 lbs. of cotton seed cost at 60c per bu. of 32 lbs.?
20. What will be the cost of 165 lbs. of flaxseed at $1.20 per bu. of 55 lbs.?
21. How much will 88 lbs. of hempseed cost at $1.10 per bu. of 44 lbs.?
22. How many yards of silk at 75c can be bought for $8.50?
23. How many yards of cheese cloth at $16\frac{2}{3}$c can be bought for $7.20?
24. How many yards of linen at $\$1.16\frac{2}{3}$ can be bought for $22.40?
25. How many yards of silk at $\$1.66\frac{2}{3}$ can be bought for $20?
26. How many pounds of sugar at $8\frac{1}{3}$c can be purchased for $2.75?
27. How many bushels of wheat at $\$1.12\frac{1}{2}$ can be purchased for $9.00?
28. What will 250 lbs. of millet cost at $2.50 per bu. of 50 lbs.?
29. How much will 44 lbs. of onion seed cost at $2.80 per bu. of 28 lbs.?
30. What will be the cost of 42 lbs. of orchard grass seed at $3 per bu. of 14 lbs.?

CHAPTER XV

PERCENTAGE

Per cent, usually indicated by the symbol "%", means by the hundred. It is used to describe fractional values expressing hundredths or a power of hundredths. The term "6%" is equivalent to "six hundredths"; "$\frac{1}{2}$%", to "five thousandths"; "$\frac{3}{4}$%", to "seventy-five ten-thousandths"; "27%", to "twenty-seven hundredths." The per cents mentioned, when expressed in the form of common and decimal fractions would be: $6\% = \frac{6}{100} = .06$; $\frac{1}{2}\% = \frac{\frac{1}{2}}{100} = .005$; $\frac{3}{4}\% = \frac{\frac{3}{4}}{100} = .0075$; $27\% = \frac{27}{100} = .27$.

The subject of percentage relates to the solution of problems in which the term "per cent" is involved. The process of solving problems in percentage is the same as that applied in the solution of problems in common and decimal fractions; the denominator of the fraction representing the per cent in percentage problems is always 100. The usual process is to indicate the number preceding the words "per cent", or the symbol "%", as a decimal fraction, when making calculations in percentage.

24% of 25 is equivalent to $25 \times .24$ or a product of 6; 8% of 62 is equivalent to $62 \times .08$ or a product of 4.96; 15% of \$12.50 is equivalent to $12.50 \times .15$ or a product of 1.875 or \$1.88. When the value of the final product in the calculations of business problems is dollars and cents, and the fractional value of the cents is one half or more, it is customary to regard it as a full cent, and when less than one half, to discard it.

PERCENTAGE TERMS AND THEIR MEANING

The term *per cent* is used in business for indicating comparisons and is the basis for compensation. The *base* is the number with which the comparison is being made, or upon which the compensation is to be calculated. The *rate* is the fractional comparison. The *percentage* is the product of the base multiplied by the rate expressed as a decimal fraction.

Wilbur York, a salesman, is to receive 8% of the sales he makes as his compensation. During the month of January, his

sales were $1,200. To ascertain the amount of his compensation (the percentage) it is necessary to multiply his sales (the base) by the rate per cent expressed as a decimal fraction; $1,200 \times .08 = 96.00$ or $96 since the base is expressed in dollars.

During the month of February, Mr. York's sales were $1,500 hence his compensation would be $120; $1,500 \times .08 = 120.00$ or $120. If it is desired to compare his February sales with the January sales and express the increase, $300, as a rate per cent, the January sales will be the base, the $300 the percentage, and the rate to be determined. Since the base multiplied by the rate equals the percentage, it is evident that the percentage divided by the base will equal the rate; $300 \div $1,200 = .25$ or 25%, the rate of increase. Mr. York sold $300 more merchandise in February than in January, and by so doing increased his sales 25%, because the $300 increase was $\frac{1}{4}$ of the January sales.

Mr. York wishes to increase his income in March to $160. To do this it is necessary for him to increase his sales because his income is 8% of his sales. Knowing his rate per cent and the income desired, he will naturally be interested in ascertaining the amount of goods he must sell in March in order to secure $160. His reasoning would doubtless be something as follows: "If $160, the income I desire, is 8% of some number, then 1% of that number would be $\frac{1}{8}$ of $160 or $20; if $20 is 1% of the number, then 100% of the number must be 100 times $20 or $2,000. This means that I must sell $2,000 worth of merchandise in March."

EXERCISE No. 138, PERCENTAGE REQUIRED

When the base and rate are given, the percentage is the product of the base multiplied by the rate expressed as a decimal fraction. The following problems provide oral practice in ascertaining the percentage when the rate (first column) and base (second column) are given.

	1			2	
a.	50%	of 150	*a.*	8%	of $250
b.	30%	" 60	*b.*	15%	" 300
c.	90%	" 90	*c.*	18%	" 300
d.	80%	" 27	*d.*	19%	" 400
e.	60%	" 60	*e.*	16%	" 100
f.	40%	" 40	*f.*	50%	" 500

EXERCISE No. 139, PERCENTAGE REQUIRED

The following problems provide written practice in ascertaining the percentage when the base and rate are given. Arrange your work on tablet paper in the same form as instructed in the multiplication of decimal fractions. When the base is expressed as dollars and cents, the product (percentage) will be dollars and cents, hence fractions of a cent are treated as a whole cent if one half cent or more, and discarded if less than one half cent.

	1			2	
a. 15%	of	3,745	*a.* 78%	of	$4,756.35
b. 37%	"	5,846	*b.* 36%	"	625.31
c. 23%	"	9,283	*c.* 58%	"	473.57
d. 21%	"	1,473	*d.* 92%	"	3,127.68
e. 34%	"	8,463	*e.* 36%	"	45.32
f. 16%	"	8,136	*f.* 48%	"	314.68
g. 22%	"	8,415	*g.* 21%	"	3,147.82
h. 14%	"	9,236	*h.* 18%	"	37.23
i. 37%	"	1,947	*i.* 81%	"	1.45
j. 45%	"	8,273	*j.* 78%	"	.94
k. 16%	"	4,836	*k.* 49%	"	6.73
l. 34%	"	9,281	*l.* 26%	"	12.78

NOTE: The base is the *multiplicand*, the rate, expressed as a decimal fraction, is the *multiplier*, and the percentage is the *product*. If the base is an abstract number, the percentage is an abstract number; if the base is a concrete number, the percentage is of the same denomination as the base. 10% of 100 is 10; 10% of $100 is $10.

EXERCISE No. 140, PERCENTAGE REQUIRED

When the rate is an aliquot part of 100, the percentage may be ascertained (a) by multiplying the base by the rate expressed as a decimal fraction, or (b) by multiplying the base by the rate expressed as a common fraction reduced to its lowest terms.

If the rate is $12\frac{1}{2}\%$ and the base is 72, the percentage is (a) $72 \times .12\frac{1}{2} = 9.00 = 9$, or (b) $72 \times \frac{12\frac{1}{2}}{100} = 72 \times \frac{1}{8} = \frac{72}{8} = 72 \div 8 = 9$. By this illustration you will note that multiplying the rate by the percentage expressed as a common fraction in its lowest terms,

is equivalent to dividing the base by the denominator of the fraction when the numerator is one.

The following problems provide oral practice in determining the percentage when the rate is an aliquot part of a dollar.

1			2		
a. 25%	of	$ 150.00	*a.* 4%	of	$ 625.50
b. 12½%	"	125.84	*b.* 50%	"	8,376.48
c. 16⅔%	"	209.64	*c.* 8⅓%	"	4,785.28
d. 8⅓%	"	1,067.40	*d.* 6¼%	"	253.60
e. 10%	"	4,856.00	*e.* 25%	"	7,486.48
f. 5%	"	3,064.80	*f.* 33⅓%	"	3,743.25
g. 20%	"	584.75	*g.* 16⅔%	"	8,753.28
h. 33⅓%	"	437.64	*h.* 12½%	"	436.24
i. 12½%	"	31.80	*i.* 50%	"	318.42
j. 66⅔%	"	291.30	*j.* 20%	"	1,921.35

EXERCISE No. 141, RATE REQUIRED

When the *base* and *percentage* are given, the *rate* is ascertained by dividing the percentage by the base. The principle involved is the same as in the proof of multiplication by division. The base is the *multiplicand*, the rate the *multiplier*, and the percentage the *product*.

The following problems provide oral practice in ascertaining the rate when the percentage and base are given.

1	2
a. 25 is what per cent of 100?	*a.* 28# is what per cent of 32#?
b. 14 is what per cent of 56?	*b.* 17½ is what per cent of 35?
c. 17 is what per cent of 51?	*c.* 18 is what per cent of 54?
d. $10 is what per cent of $100?	*d.* 15# is what per cent of 60#?
e. $125 is what per cent of $1,000?	*e.* 25c is what per cent of $1.00?
f. 21# is what per cent of 56#?	*f.* 44# is what per cent of 220#?
g. 10 is what per cent of 100?	*g.* 25 is what per cent of 625?
h. 9 is what per cent of 81?	*h.* 18 is what per cent of 90?
i. 13 is what per cent of 91?	*i.* 125 is what per cent of 625?
j. 66⅔ is what per cent of 200?	*j.* 61 is what per cent of 183?

EXERCISE No. 142, RATE REQUIRED

Since the percentage is the result of the base multiplied by the rate, it is evident that the percentage divided by the base will give the rate.

```
          .181+
287.64)52.15000
       28 764
       23 3860
       23 0112
          37480
          28764
           8716
```

The illustration at the left shows the method of ascertaining the rate when the base is $287.64 and the percentage, $52.15. The percentage is the dividend and the base is the divisor. Since the quotient is in thousandths, the rate is .181+ = 18.1+%.

NOTE: It is necessary to keep in mind the fact that the rate is the numerator of a fraction, the denominator of which is hundredths; hence, the quotient in the process of division, in which the base is the divisor and the percentage is the dividend, will be a decimal fraction. When the base is not contained in the percentage an exact number of hundredths of times, the division should be continued, in decimal fractions, to at least three decimal places.

The following problems provide written practice in ascertaining the rate when the base and percentage are given. Show your solutions on tablet paper as in the illustration.

1. 445 is what per cent of 1,262?
2. 318 is what per cent of 900?
3. 756 is what per cent of 252?
4. 1,644 is what per cent of 32,508?
5. $375.55 is what per cent of $2,408.40?
6. $252.50 is what per cent of $2,500?
7. 1,018 is what per cent of 16,485?
8. 327 is what per cent of 585?
9. 25,562 ft. is what per cent of 100,570 ft.?
10. 750 is what per cent of 150?
11. 3,265 is what per cent of 12,440?
12. $90.90 is what per cent of $9,090?

EXERCISE No. 143, BASE REQUIRED

When the rate and percentage are given, the base is ascertained by dividing the percentage by the rate expressed as a decimal fraction. The principle involved is the same as in the proof of multiplication by division. The base is the multiplicand, the rate, the multiplier, and the percentage, the product.

The formula given in the third illustration of Mr. York's sales on page 182 may be of assistance in helping you to understand the solution of these problems. Applied to problem "a" in No. 1, the statement would be as follows: if 144 is 12% of some number, 1% of the number would be $\frac{1}{12}$ of 144 or 12; if 1% of the number is 12, 100% of the number would be 100 times 12, or 1,200.

The following problems provide oral practice in ascertaining the base when the rate (first column) and percentage (second column) are given.

1	2	3
a. 12%...144	*a.* 7%....81.00	*a.* 12½%... 24.00
b. 10%...280	*b.* 11%.... 2.20	*b.* 20%.... 5.00
c. 15%...450	*c.* 15%.... 4.50	*c.* 16⅔%... 6.00
d. 3%...225	*d.* 15%....45.00	*d.* 75%.... 2.25
e. 6%...120	*e.* 14%.... 2.80	*e.* 40%.... 1.60
f. 7%...490	*f.* 7%.... .72	*f.* 25%.... 5.00
g. 15%...600	*g.* 7%.... 8.10	*g.* 25%.... 25.00
h. 20%...320	*h.* 9%.... 1.80	*h.* 10%.... .10

EXERCISE No. 144, BASE REQUIRED

When the rate and percentage are given, and it is necessary to write the solution, it is advisable to express the rate in the form of a decimal fraction before dividing. Thus if the rate is 18¼%, and the percentage is $66.66, the solution requires that $66.66 be divided by .1825, as illustrated below.

```
          365.26
        ----------
.1825)66.660000
      54 75
      ------
      11 910
      10 950
      ------
        9600
        9125
        ----
        4750
        3650
        ----
        11000
        10950
        -----
           50
```

In the problem at the left, there are four decimal places in the divisor, and only two in the dividend, hence it is necessary to annex two ciphers. The result of dividing the dividend by the divisor with these ciphers annexed will be dollars. Since there is a remainder after finding the dollars, it is necessary to annex additional ciphers in order to ascertain the cents. Since the remainder is less than one half, it is discarded. If it had been more than one half, another cent would have been added to the quotient.

The following problems provide written practice in ascertaining the base when the rate and percentage are given. Show on tablet paper, the base expressed as dollars and cents, if the percentage is in dollars and cents, or as a mixed number with the fraction expressed decimally in ten-thousandths.

1	2	3
a. 27% .. $ 22.52	*a.* 7.4% ... 361	*a.* 12½% .. $287.62
b. 7% .. 181.65	*b.* 29% ... 127	*b.* 33% 55.42
c. 9% ... 54.55	*c.* 3¼% ... 525	*c.* 16% 34.14
d. 28% ... 43.15	*d.* 21½% ... 87.5	*d.* 75% 241.04
e. 13% ... 38.65	*e.* 3.68% ... 72.60	*e.* 66% 205.87
f. 15% ... 44.44	*f.* 15.7% ... 261.3	*f.* 8% 51.65
g. 44% ... 98.89	*g.* 8.8% ... 541.52	*g.* 20% 201.11
h. 31% ... 36.42	*h.* 16¾% ... 72.5	*h.* 37½% ... 55.56

EXERCISE No. 145, APPLICATION OF THE TERMS

The following problems provide written practice in the solution of percentage problems. Copy on tablet paper in the same form as the problems are stated, inserting the correct figures where question marks are given; mark the figures you have supplied by drawing a line under them. Submit with the problems all your calculations, expressing the rate decimally in ten-thousandths.

When the base and percentage are given in one amount and the percentage is a separate amount, subtract to ascertain the base; when the base, less the percentage, is given in one amount, and the percentage is a separate amount, the base is the sum of the two. With any two of the three essential elements given, the third can be ascertained by multiplication or division.

	Base	Rate	Percentage	B.+P.	B.−P.
1.	$1,678.40	25%	?	?	?
2.	?	?	$37.08	$301.93	?
3.	$1,264.75	?	$189.71	?	?
4.	?	?	77.27	?	$566.62
5.	$7,843.20	18%	?	?	?
6.	$1,657.45	8%	?	?	?
7.	$9,864.37	?	$3,452.53	?	?
8.	?	?	192.34	$1,671.89	?

	Base	Rate	Percentage	B.+P.	B.−P.
9.	?	?	122.06	?	$1,621.59
10.	?	?	1,865.51	?	6,614.10
11.	$6,543.90	$16\frac{2}{3}\%$	?	?	?
12.	$7,864.85	?	?	$8,651.34	?
13.	$3,487.70	?	?	?	$3,175.41
14.	$4,874.44	?	536.19	?	?
15.	?	?	563.22	$9,950.22	?
16.	?	?	361.85	9,408.05	?
17.	$5,580.10	$2\frac{1}{2}\%$	?	?	?
18.	$4,589.40	?	917.88	?	?
19.	246.00	?	?	258.30	?

EXERCISE No. 146, SALES PROBLEMS

Whether a salesman receives a salary as compensation for his services, a combination of salary and commission, or commission only, the value of his services to the business concern which employs him is always measured by his sales. If he receives a salary, and his sales do not compare favorably with those of the other salesmen working under the same conditions, he will eventually be replaced by a more efficient salesman.

It is necessary for a business concern to keep a record of all sales in order to measure the efficiency of its sales organization. For the reasons just explained, it is necessary to record the sales made by each salesman, and use the facts resulting from this record as a means of measuring the efficiency of each salesman. The comparison of sales, and the compensation based on sales, are best expressed as a rate per cent.

The following problems provide written practice in the application of percentage to the problems of the owner of a business or the one responsible for the sales.

1. The Brown Grocery Company employed four salesmen. During the month of January their sales were as follows:

Brown.....	$2,750.45	Smith.....	$2,309.16
Clark.....	2,396.48	Snyder.....	2,845.87

Each salesman was allowed a commission of $8\frac{1}{2}\%$ of his sales. You are to ascertain: (a) the total sales of the four salesmen; (b) the average sales for the month; (c) the rate per cent each salesman was above or below the average; (d) the commission due each salesman for the month.

2. During February, the sales of the four salesmen mentioned in problem 1 were as follows:

Brown.....	$2,954.55	Smith.....	$2,145.72
Clark.....	2,463.68	Snyder.....	2,800.85

Show all your calculations necessary to ascertain: (a) the average sales for February; (b) the per cent of increase or decrease of the average as compared with the January sales; (c) the increase or decrease of each salesman's sales over the preceding month; (d) the per cent of this increase or decrease; (e) the commission due each salesman on the February sales.

3. The L. J. Mann Hardware Company has four salesmen each of whom receives a salary for his services. During the month of July the sales of each salesman were as follows:

Bates.....	$829.63	Day.....	$1,017.30
Davis.....	641.92	Jones.....	913.55

You are to ascertain: (a) the total sales made by the four salesmen; (b) the average sales of the four salesmen; (c) what per cent each salesman's sales were above or below the average.

4. Warren Brothers, retail dry goods merchants, have four salesmen, each of whom receives a definite salary, plus a commission of 2% on the sales he makes above the average sales. During the month of August the sales of these four salesmen were as follows:

Hays.....	$1,142.96	Knight.....	$1,429.94
Joyce.....	1,233.96	Ross.....	1,646.42

You are to show on tablet paper all of your calculations necessary to ascertain (a) the average sales, and (b) the commission due each salesman who is above the average.

5. The twelve salesmen listed below comprise the sales force of The Hunt Manufacturing Company. At the close of the current business year the sales of each salesman were as follows:

Bates...	$13,167.44	Davis...	$15,095.33	King....	$11,412.96
Bauer..	13,498.72	Daly....	15,809.88	Rowe...	12,331.97
Craig...	13,782.22	Hale....	14,166.18	Saylor...	13,209.76
Culp...	10,773.50	Joyce...	13,224.65	Smith...	12,709.43

Each salesman is to receive as compensation for his services a

salary of $200 per month and a commission of $3\frac{1}{2}\%$, if his sales are the average or more than the average, and only $2\frac{1}{2}\%$, if his sales are less than the average. You are to ascertain: (a) the total sales for the year; (b) the average sales; (c) the commission due each salesman for his sales during the year as per agreement; (d) the total income of each salesman for the year; and (e) the rate per cent of cost of each salesman's sales on $100 unit basis.

NOTE: $100 unit basis means that the salesmen's sales are expressed in even hundred dollars. Thus, the sales made by Mr. Bates will be expressed as $13,200; Mr. Daly, $15,800; Mr. Hale, $14,200; Mr. Saylor, $13,200, etc.

EXERCISE No. 147, RATE PER CENT OF PROFIT

When property is purchased and sold by an individual who is not engaged in a business enterprise, it is customary to use the cost price as the base to ascertain the per cent of profit or loss.

The following problems provide oral practice in ascertaining the per cent of profit or loss when the cost is used as the base.

When the percentage (profit or loss) is an aliquot part of the base (cost price) the rate will be the same aliquot part of 100%. Thus, in the first problem the profit, $100, is one third of the base; hence the rate is $33\frac{1}{3}\%$, because this is one third of one hundred per cent.

	1.		2.	
	Cost	Selling Price	Cost	Selling Price
a.	$300.00	$400.00	$ 2.50	$ 3.50
b.	200.00	300.00	125.00	150.00
c.	250.00	300.00	16.00	20.00
d.	800.00	900.00	17.50	20.00
e.	500.00	750.00	37.50	50.00
f.	25.00	30.00	15.00	12.50
g.	2.50	5.00	17.50	15.00
h.	12.50	15.00	125 00	100.00

EXERCISE No. 148, PROFIT AND LOSS

The problems on page 191 provide written practice in ascertaining the profit or loss and per cent of profit or loss based on *cost*. You are to show on tablet paper all the calculations necessary to ascertain (a) the profit or loss, and (b) the per cent of

profit or loss expressed as an integer, or a mixed number with the fraction expressed decimally in hundredths.

	1.		2.	
	Cost Price	Selling Price	Cost Price	Selling Price
a.	$ 1,650.45	$ 1,995.50	*a.* $335.00	$330.00
b.	550.00	725.00	*b.* 825.50	820.25
c.	225.45	200.50	*c.* 99.95	97.65
d.	775.25	815.65	*d.* 104.14	115.66
e.	12,500.00	14,650.00	*e.* 4.75	6.25
f.	200.50	192.25	*f.* 44.50	41.20

EXERCISE No. 149, PROFIT AND LOSS

It is customary for the merchant or manufacturer to use the selling price as the base in all calculations. Thus, if a merchant sells an article for $1.25 and the cost price is $1, the per cent of profit is calculated on $1.25, the selling price, instead of $1, the cost price. The same mathematical process is applied, whether the selling price or cost price is used as a base; but the rate per cent will be different because the cost price is different from the selling price. Thus, the per cent of profit on the sale referred to above, if based on the selling price, would be 20%, and on the cost price, 25%.

The following problems provide oral practice in ascertaining the per cent of profit or loss resulting from a sale, when the selling price is used as a base.

	1.		2.	
	Cost Price	Selling Price	Cost Price	Selling Price
a.	$1,250.00	$1,500.00	*a.* $25,000.00	$30,000.00
b.	1,000.00	1,200.00	*b.* 21,000.00	28,000.00
c.	1,500.00	1,800.00	*c.* 1,500.00	1,200.00
d.	1,400.00	1,600.00	*d.* 37,500.00	50,000.00
e.	7,500.00	9,000.00	*e.* 32,000.00	40,000.00
f.	8,400.00	9,600.00	*f.* 1,250.00	1,000.00
g.	13.50	15.00	*g.* 7,500.00	8,000.00
h.	5,280.00	6,000.00	*h.* 9,900.00	9,000.00
i.	7,200.00	8,000.00	*i.* 8,500.00	8,000.00

EXERCISE No. 150, RATE PER CENT OF PROFIT OR LOSS

The following problems provide written practice in ascertaining the per cent of profit or loss when the cost and selling price are given, and the selling price is to be used as the base.

	1.		2.	
	Cost Price	Selling Price	Cost Price	Selling Price
a.	$22,451.75	$24,526.60	$17,716.65	$17,005.04
b.	1,237.55	1,152.40	7,622.55	8,004.05
c.	12,862.65	16,911.40	2,262.65	2,141.50
d.	7,827.65	8,001.01	8,887.18	9,919.90
e.	32,786.65	38,242.55	4,465.86	4,392.99
f.	9,900.50	10,400.25	1,255.15	1,400.75

NOTE: Express the rate per cent as an integer, or mixed number with the fraction expressed decimally in thousandths.

EXERCISE No. 151, DEPRECIATION

When a business man purchases an automobile, a motor truck, a typewriter, or other property of similar nature for use in the operations of his business, it is necessary to take into consideration the decrease in the value of this property because of its use, otherwise his records will not show the correct amount of profit or loss resulting from the operation of the business. This decrease in value is taken care of through recording as depreciation a certain per cent of the cost value of the property, usually at the end of each business year during its ownership. The per cent decided upon as the amount of depreciation is based on cost price.

If a motor truck costs $2,500 and it is decided that it should be depreciated 20% each year, $500 or one fifth of the cost value is recorded each year as the depreciation. The present, or "book", value of the truck is ascertained by subtracting the depreciation from the cost value of the truck.

The following problems provide written practice in ascertaining the present value of property which will depreciate because of its use. Copy the problems as given, inserting the correct amounts where the question marks appear. When completed, the first column will show the cost of the article; the second, the rate of depreciation each year; the third, fourth, fifth, and sixth the depreciation for each of the four years; and the seventh, the value of the property after deducting the depreciation for the four years.

	Cost	Rate	1st Year	2d Year	3d Year	4th Year	Present Value
1.	$2,200	20%	?	?	?	?	?
2.	2,500	15%	?	?	?	?	?
3.	100	18%	?	?	?	?	?
4.	375	12½%	?	?	?	?	?
5.	5,000	17%	?	?	?	?	?
6.	3,500	20%	?	?	?	?	?
7.	750	15%	?	?	?	?	?
8.	1,000	16%	?	?	?	?	?
9.	125	20%	?	?	?	?	?
10.	140	14%	?	?	?	?	?
11.	2,850	17%	?	?	?	?	?
12.	1,675	15%	?	?	?	?	?

NOTE: When the property is sold or exchanged for new property, a record of the cost and depreciation will be of assistance in arriving at an equitable price. In case of a fire, it is necessary to know the present value in order to collect the loss from the insurance company.

EXERCISE No. 152, COST OF MERCHANDISE SOLD

The merchant does not always know the exact cost of each article sold, but he does know, at the end of the year, the cost of all merchandise sold during the year. This information is ascertained from (a) the cost of merchandise on hand at the beginning of the year, (b) the cost of merchandise bought during the year, and (c) the merchandise on hand at the end of the year. The cost of merchandise bought includes (a) the invoice cost of the merchandise bought, less the value of any merchandise returned, plus (b) the transportation cost.

Percentage may be used to an advantage in comparing the various items which enter into the cost of merchandise purchased. The merchant is interested in having a comparison of these facts in order to better control the cost of future purchases.

If the value of the merchandise on hand at the beginning of the year was $2,000 and the purchases cost of merchandise during the year, $3,000, it is quite evident that there should be in stock at the end of the year merchandise to the value of $5,000 if none has been sold. If the inventory shows that the value of merchandise on hand is only $1,500, it is quite evident that the merchandise sold during the year cost $3,500. This is the difference between the amount that should have been on hand if none had been sold and the amount that is on hand.

The following problems provide written practice in applying percentage to purchase costs.

1. A. L. Young had $12,416.84 worth of merchandise on hand at the beginning of the year and $11,642.50 on hand at the end of the year. It is desired to know (a) the difference between the two inventories, and (b) the per cent of decrease in the value of the inventory at the end of the year when compared with the beginning inventory.

2. J. C. Smith purchased merchandise amounting to $19,871.62 during a certain year and paid transportation cost on this amounting to $1,141.36. It is desired to know the per cent of transportation cost on purchases.

3. During the same year applicable to problem 2, the returned purchases, that is the merchandise returned to creditors, was $1,004.65. What per cent of the merchandise bought was returned?

4. The following facts are recorded in the ledger of George Busse, a retail merchant: total purchases, $61,748.55; transportation cost, $2,748.65. During the previous year the total purchases were $75,527.86 and the transportation cost, $3,165.54. Mr. Busse wishes to know (a) the comparison in per cent of the purchases for the two years, (b) the comparison in per cent of the transportation cost for the two years, (c) the per cent of transportation cost on purchases for this year, and (d) the per cent of transportation cost on purchases for the previous year.

5. The bookkeeping records show the following facts affecting the goods sold this year: beginning inventory, $14,651.72; purchases during the year, $28,765.92; returned purchases, $562.90; freight, $864.95; ending inventory, $9,756.82. The same facts for the preceding year were: beginning inventory, $15,562.40; purchases, $25,987.62; returns, $659.80; freight cost, $1,242.41; ending inventory, $14,651.72. You are required to show the calculations necessary to ascertain: (a) cost of the goods sold this year; (b) cost of the goods sold last year; (c) the per cent of increase or decrease; (d) the per cent of comparison of the beginning inventory this year with last year; and (e) the per cent of comparison of the ending inventory this year with last year.

EXERCISE No. 153, SALES

The profit on a sale of merchandise is ascertained by subtracting from the net sales the net cost of the merchandise sold. The net sales are the total sales less any returns made by customers. The method of ascertaining the cost of merchandise sold is explained in Exercise No. 152. It is customary to use the net sales as a base when ascertaining the rate per cent of income on sales or operating expense. It is only when a comparison of items which enter into the cost is desired that the cost is used.

The following problems provide written practice in applying percentage to business problems involving buying and selling of merchandise and expenses in connection therewith.

1. Cost of merchandise sold, $14,786.95; selling price, $17,562.40. You are required to show on tablet paper the calculations required to find the per cent of profit.

2. Total sales during the year were $32,561.40; returns of merchandise by customers, $846.65. What per cent of the merchandise sold was returned?

3. Total sales during the year were $85,962.40; total selling expenses including total expense of salesmen, $9,762.40. What per cent of the sales are the selling expenses?

4. Total sales, $587,642.95; merchandise returned by customers for credit, $1,262.40; allowances granted customers because goods were not up to standard, $462.75; total selling cost, $32,562.54; total administrative cost, $31,562. You are required to show the calculations necessary to ascertain (a) the per cent of merchandise returned by customers, (b) the per cent of allowances to customers, (c) the rate per cent of selling expense, and (d) the rate per cent of administrative expense.

5. Cost of merchandise sold, $458,962.95; sales, $654,527.55. What was the per cent of profit?

CHAPTER XVI

PERCENTAGE PROBLEMS

The following problems provide written practice in applying the principles of percentage as explained in the preceding chapter. Show on tablet paper all the calculations necessary to arrive at the facts desired, and prove all of your answers.

1. The following items are quoted from a bargain sale advertisement. The first amount is the former sale price, and the second is the present sale price. You are to ascertain (a) the reduction in price, and (b) the per cent of this reduction based on the former price.

a. $15 coats at $12.50
b. $4 dresses at $3
c. $5 dresses at $4.50
d. $3 galoshes at $2.50
e. $35 coats at $20
f. $20 coats at $12
g. $30 dresses at $18
h. $50 rugs at $40
i. $120 rugs at $90
j. $6 shoes at $3.50
k. $8 shoes at $5
l. $10.50 shoes at $7

2. January 2, James Bigelow purchased a used Buick automobile for $1,250. January 4, he sold this car for $1,400. Ascertain (a) the profit and (b) the per cent of profit.

3. January 2, C. H. Reed paid $2,150 for a new automobile. December 31 of the same year he purchased another automobile, and received $950 credit on the purchase price for the used car. (a) How much was the depreciation; that is, the difference between the cost of the used car and its exchange value? (b) What was the rate per cent of monthly depreciation?

4. A. L. Downing paid $5,500 for a farm and sold it for $6,250. How much was his per cent of profit after paying $55.80 for taxes?

5. The Brown Manufacturing Company paid $2,700 for a machine on January 2. The bookkeeper is instructed to depreciate

the machine at the rate of $12\frac{1}{2}\%$ each year. After keeping the machine for four years, it was exchanged for a new machine at an exchange allowance of $972. (a) What was the book value of the machine when exchanged? (b) What should have been the rate of yearly depreciation to have absorbed all of the depreciation?

6. Walter Brown paid $1,500 for a lot, and $6,275.80 for the construction of a house. In addition to the cost of the house and lot, he paid $250 for paving assessments, and $82.50 for taxes. He sold the lot, and house upon completion, for $9,000. What was (a) the net profit, and (b) the per cent of profit?

7. At the beginning of the business year, July 1, Martin Brothers, retail grocers, had in stock merchandise valued at $9,654.55. June 30 of the next year, the record of purchases showed, $12,621.65; transportation cost, $927.75; total sales, $20,467.75; returned sales of customers, $527.75. The cost value of merchandise in stock June 30, as shown by the inventory was $5,522.20. They desire to know (a) the profit on merchandise sold during the year, and (b) the per cent of profit.

When the rate per cent is a mixed number, show the value of the fraction decimally in hundredths.

8. From the following facts ascertain: (a) the cost of merchandise sold; (b) net sales; (c) the profit on sales; and (d) the per cent of profit on sales, based on net sales.

Beginning inventory	$ 67,526.98
Purchases	127,642.75
Returned purchases	1,051.62
Transportation cost	4,827.38
Ending inventory	9,468.46
Total sales	199,461.58
Returns by customers	984.55

9. Beginning inventory, $37,462.91; purchases during the year, $52,827.36; ending inventory, $30,562.44. (a) What per cent of the goods purchased was sold? (b) If the selling price was 25% in excess of the cost, what were the total sales for the year?

10. May 1, Adolph Howe paid $8,500 for a house and lot which was occupied at a rental of $75 per month. May 10, he paid for repairs and painting, $285.65; June 1, collected rent of $75; July 1, paid taxes, $191.87; July 1, collected rent, $75;

August 1, collected rent, $75; August 15, paid insurance, $24; September 1, collected rent, $75; September 5, sold property to the occupant for $11,250. Mr. Howe desires to know (a) the amount of profit made on this sale, and (b) the per cent of profit based on the purchase price of the property.

11. June 5, J. B. Hall paid $775 for a used Studebaker automobile. June 10, he sold this car for $825. He desires to know (a) the profit and (b) the per cent of profit based on the cost. June 15, he paid taxes which were assessed against the car while in his possession. (c) What effect will this have on the profit and the per cent of profit?

12. C. H. Dobson, a farmer, paid $1,500 for a truck to be used in connection with the operations of his farm. The rate of depreciation set up by the tax commission was 30% the first year, 25% additional the second year, and 15% additional each year thereafter. This means that the taxable value of the truck at the end of the first year was cost less 30%, or $1,050, and the second year, cost less 55%, the third year, cost less 70%, etc. At the end of the third year the truck was destroyed by fire. Mr. Dobson carried fire insurance of $700. What amount should he collect from the insurance company based on the taxable depreciation?

13. I. L. Pierson, a farmer, collected in cash from the sales of farm products in a given year, $3,562.48. He paid as expenses in operating the farm for the same year, $722.65. You are to ascertain (a) his net profit, and (b) what per cent of his sales are his expenses.

14. The Model Laundry purchased a delivery truck for $1,800 and kept it for four years. During the first year, it was depreciated 35%, the second year, 20%, the third year, 15%, and the fourth year, 10%, in accordance with the tax schedule. At the end of the fourth year it was exchanged for another truck at an exchange allowance of $750. You are to show on tablet paper the calculations necessary to determine: (a) the book value of the truck at the time it was exchanged; (b) the difference between the exchange value and the book value; and (c) the rate per cent this difference is above or below the book value.

15. The sales manager for the Van Horn Manufacturing Company wishes to establish an average rate per cent of cost of sell-

ing. The records for the current year show total sales, $862,981.50, and total cost of sales, $90,613.06. (a) What was the rate per cent of cost of selling, and (b) how much above or below this average was J. H. Hurdig whose sales were $29,684.72 and whose cost of selling was $4,155.86?

16. Your father paid $1,200 for a lot on which to build a home. Before building operations were begun, he sold the lot at a profit of $66\frac{2}{3}\%$, and bought another lot at 20% less than the selling price of the first one. (a) What did he receive for the first lot? (b) What did he pay for the second lot? (c) What was the net profit? (d) What was the per cent of net profit?

17. The number of high school graduates increased from 21,880 at the end of the nineteenth century to 224,367 thirty years later. What was the per cent of increase?

18. In a recent year there were 81,034 high school teachers as compared to 9,120 thirty years before. What was the per cent of increase?

19. The population of a certain city was 407,621 in one census year, and 502,682 in the next census year. (a) What was the increase in population in this city; and (b) the per cent of increase?

20. A certain city shows an increase in birth rate of 2,475 in one year. This is $1\frac{7}{8}\%$ increase. Find the birth rate for the previous year.

21. A star ballplayer batted for the week as follows: Monday, at bat 5 times and made 3 hits; Tuesday, 4 times, 1 hit; Wednesday, 4 times, 4 hits; Thursday, 3 times, 2 hits; Saturday, up 7 times in a "double header" and made 5 hits. What was his batting average for the week?

22. The population of a certain city was 363,891. During one year the number of deaths was 6,330. What was the per cent of death rate per thousand population?

23. Robert B. Hase operates The Electric Shop and carries a stock of electrical fixtures; he also provides mechanics for installing these. At the end of the business year, his net cost of merchandise purchased and labor cost was $12,487.39; inventory of electrical fixtures in stock, $1,855.42; his sales during the year, which includes the sale of both services and fixtures, were $21,749.82; his expenses, which include rent, heat, light, in-

surance and office help, were $5,827.36. He desires to know: (a) the cost of merchandise and services sold; (b) the profit on these sales; (c) the net profit after deducting the expenses from the profit on sales; and (d) the per cent of net profit.

24. S. L. Robinson buys job lots of paper from the paper mills and sells to the printers. April 5, he purchased from the Beckett Paper Mill 215,500 lbs. of paper at 8c per lb.; April 7, he sold 55,200 lbs. at $9\frac{1}{2}$c; April 8, he sold 27,500 lbs. at $9\frac{3}{8}$c; April 9, 62,850 lbs. at $9\frac{1}{4}$c; April 10, sold the balance at $8.95 per 100 lbs. The expense in connection with the sale of this paper was $175.50. He desires to know (a) the profit made on the sale of this job lot of paper and (b) the per cent of profit based on the sales.

25. During a certain year R. L. Dougherty, a retail clothing merchant paid $8,142.55 selling expenses, and his sales for the year amounted to $65,287.82. What was the rate per cent of selling cost?

26. The purchases of merchandise by the Fair Store during the month of January were $18,642.91. The returns of merchandise to creditors were $762.91. The allowances by creditors for damaged goods were $82.65. (a) What per cent of merchandise purchased was returned, and (b) what per cent of the total purchases was the allowances?

27. The gross sales of the Gidding Company during the month of December were $28,672.91. Merchandise returned by customers for credit during this month was $587.63. Credit was allowed to customers because the merchandise sold was not satisfactory. You are required to ascertain: (a) the net sales; (b) the per cent of returns based on gross sales. (c) What per cent of the net sales were the allowances?

28. A corporation increased its capital stock 50%. At the end of the first business year thereafter a stock dividend of $9,000 was paid to stockholders, which was 6% of the present capital. What was the capital stock before the increase?

29. A dealer sold 315 hogs which was $37\frac{1}{2}$% of the number he had bought during the week. (a) How many did he have left, and what per cent was unsold?

30. The Brown Manufacturing Company, manufacturers of clothing, wish to know the rate per cent of the selling cost of merchandise manufactured and sold. The following facts affecting these operations are recorded in the ledger:

Traveling salesmen's salaries	$ 35,500.00
Traveling salesmen's expenses	28,642.50
Advertising	9,427.50
House salesmen	14,279.90
Total sales	786,962.87
Returns by customers	2,412.50

NOTE: Use as a base the total sales less the returns by customers.

31. The sales manager of the Day Manufacturing Company wishes to know (a) the cost per square mile, and (b) the cost of business per 1,000 inhabitants for each of the 36 salesmen employed by the company. The following are the facts necessary to ascertain the information for A. B. Short and C. H. Williams, two of these salesmen. The territory assigned to Mr. Short contains 70,500 square miles and 7,800,000 population, and the territory traveled by Mr. Williams contains 90,600 square miles and 6,750,000 population. Mr. Short's salary and expenses were $6,250, and Mr. Williams' salary and expenses, $7,150. Ascertain the desired information for the sales manager as applied to each of these two salesmen.

32. The sales manager of the Day Manufacturing Company mentioned in problem 31, wishes to know the sales in cents, or in cents and dollars, per 1,000 population for each of the 36 salesmen. The sales of A. B. Short were $52,561 and Mr. Williams, $61,587.40. You are to ascertain the desired information for the sales manager.

33. During the year A. L. Patton, a farmer, received cash as follows:

Farm products	$2,761.55
Chickens and eggs	527.40
Milk and butter	722.52
Cattle and hogs	1,299.87

He desires to know: (a) the total sales; and (b) what per cent of the total sales is each of the products mentioned.

34. The Hayes Manufacturing Company, manufacturers of radio parts, finds it necessary to secure a new location and has a very favorable proposition from another city. However, the acceptance of this proposition would increase the freight cost on the merchandise and raw material which it must purchase, because it would be located farther from the source of supplies. The ledger shows the following facts:

Total purchases during the year...	$22,875.36
Freight on this.....	962.88

It is desired to know what per cent of the purchases is the freight, that a comparison may be made with the estimated rate which would be applicable to the new location.

35. November 19, J. B. Daily paid $14,500 for a house and lot. November 10, he paid $140 for insurance on a $7,500 fire insurance policy; December 1, collected rent, $125; December 15, paid taxes, $495.50; January 1, collected rent, $125; February 1, collected rent, $125. February 2, his house was damaged by fire. February 10, collected $4,500 from the insurance company; March 1, collected rent, $125; March 13, paid contractor for repairing building, $5,200; April 1, collected rent, $125; May 1, collected rent, $125; and on May 2, sold the house for $16,000. He wishes to know (a) whether he has made or lost on the purchase and sale of this property, and (b) the per cent of profit or loss based on the first cost of the property.

36. The sales of C. H. Hyatt, a clerk in the Peoples Department Store, for a certain week were $544.65. If his salary that week was $40 plus $1\frac{1}{2}\%$ commission on his sales, what was the rate per cent of cost of his sales?

37. A merchant realizes a profit of $12\frac{1}{2}\%$ above all cost in operating his business. If the cost of operation was $2,750, and the cost of goods sold, $10,000, (a) what were the total sales and (b) what was the net gain?

38. The gross profit of Roberts Bros., retail clothiers, during a certain year was $65,000. During the same year the cost of operations was $25,000. If the net profit was $12\frac{1}{2}\%$ of the total sales, what was the amount of the total sales?

39. C. C. McDaniels, a retail clothier, wishes to know whether he has made or lost on the operations of his business during the past year and submits the following facts as a basis for obtaining this information:

Merchandise on hand at the beginning of the year	$ 4,561.87
Cost of merchandise purchased during the year	21,962.70
Transportation cost	671.80
Returned purchases	317.65
Sales for the year	28,509.87
Returned sales	362.55
Operating expenses for the year	7,241.55

Show (a) the profit or loss on sales, and rate per cent based on net sales; (b) rate per cent of cost of merchandise sold based on sales; and (c) rate per cent of expenses based on sales.

40. January 3, the Prompt Service Electric Company paid $1,450 for an automobile truck for delivery purpose. The rate of depreciation recorded on the books as fixed by the tax laws was 30% the first year, 20% additional the second year, 15% additional the third year, and 10% additional for each year thereafter. They kept this truck for 4 years and traded it in for a new one being allowed $652.24 exchange value. (a) What was the book value of the truck according to the tax schedule, and (b) what is the difference in per cent between the exchange value and the book value compared to the cost value?

41. The Jones Printing Company paid $2,965.50 for advertising during a certain year. The net sales during this same year were $30,564.80. What per cent of the net sales was the amount paid for advertising?

42. The average daily circulation of a certain newspaper during one year was 16,587. The daily average circulation for the succeeding year was 17,962. What was the per cent of increase in the circulation?

43. The total valuation for tax purpose in a certain city was $44,475,465. The estimated expenses for operating the city during a year was $1,041,065. What tax rate per thousand dollars will be necessary in order to secure the estimated expenses?

44. The freight rate between two cities on a given commodity was \$1.415 per hundred lbs. The Interstate Commerce Commission reduced the rate to \$1.3575 per hundred lbs. What was the per cent of this decrease?

45. The tariff rate for rooms in a certain hotel in accordance with location was \$5, \$4, \$3, and \$2 per day. Competition forced the management to readjust the tariff rate, and the new rates were fixed at \$4.50, \$3.50, \$2.50, and \$1.75. What was the per cent of the reduction on each of the four classes of rooms, which you may indicate in your answer as a, b, c, and d.

46. The freight rate by rail transportation between two cities is \$0.445 per hundred lbs. The freight rate by motor bus transportation is \$3.75 per thousand lbs. (a) What per cent less is the motor rate than the rail rate; (b) what per cent greater is the rail rate than the motor rate; and (c) what would be the saving on a shipment weighing 15,575 pounds?

47. The cost of shipping a package by parcel post is \$1.45 and by express \$1.65. What per cent is saved by shipping by parcel post, assuming that it costs 10c to send the package to the post office, and the express company calls for the package without charge?

48. C. W. Curtis sold 50 hogs at the market price on date of delivery. He started them to market by truck and expected their delivery on January 18 at which time the market price was \$7.85 per hundred lbs. Owing to a break-down and a delay incident to repairs the shipment was not delivered until January 19, on which day the market price was \$7.77 per hundred lbs. The total weight of the hogs was 11,581 lbs. (a) How much did he lose because of this break-down, and (b) what was the per cent of loss?

49. C. H. Dewey paid \$11,500 for a farm containing 165 acres. He sold 5 acres at \$100 per acre, 25 acres at \$90 per acre, 40 acres at \$85 per acre and the remainder at \$60 per acre. (a) What profit did he make on the sale of this farm; and (b) what per cent of profit on the amount invested?

50. The freight rate on a certain classification of merchandise between Pittsburgh and Buffalo is \$0.4575 per 100 lbs., and between New York and Pittsburgh on the same classification,

$0.4925. C. H. Longenecker in Pittsburgh has a price of 78c per unit on this classification of merchandise from a manufacturer in Buffalo, and 76c per unit from a manufacturer in New York. If he wishes to buy 8 gross of these units and each weighs $22\frac{1}{2}$ lbs. packed, (a) would it be cheaper to buy from the manufacturer in Buffalo or New York, the Buffalo manufacturer offering 3%, 10 days, and the New York manufacturer, 2%, 10 days; (b) how much would be saved; and (c) what would be the per cent of saving using the lowest cost price as the base?

51. Find the standings of the following baseball teams:

A. Won 66, lost 47.
B. Won 69, lost 39.
C. Won 57, lost 53.
D. Won 66, lost 41.
E. Won 49, lost 57.
F. Won 63, lost 60.
G. Won 65, lost 40.
H. Won 70, lost 31.

52. R. H. Kincaid received a tax bill from the county treasurer for $241.75. What is the rate per thousand dollars if the assessed value of his property is $21,500.

53. P. M. Davis paid a broker $265.50 for five $50 bonds. What was; (a) the cost per bond; and (b) the per cent above the par value of $50?

54. John Smith, a shoe salesman, made the following sales during each of the months of a certain year:

January.....	$3,671.45	July.....	$3,556.75
February.....	4,857.55	August.....	3,889.55
March.....	3,985.35	September.....	4,076.50
April.....	4,240.75	October.....	4,175.25
May.....	4,769.25	November.....	4,555.75
June.....	3,750.80	December.....	4,965.25

It is desired to ascertain: (a) his total sales for the year; (b) his average sales per month; (c) a comparison of the sales each month with the average; and (d) the per cent of the increase or decrease.

55. The following facts appeared in a certain city daily where four newspapers are published. The figures given are the display lines, which is the unit of measurement for advertising used by local and national advertisers. The newspapers are described by number. The figures in the first column apply to advertising space by local businesses and the second column by businesses outside of the city. You are required to show on tablet paper the calculations necessary to ascertain: (a) the total number of display lines by each newspaper; (b) the total number of display lines carried by the four newspapers; (c) what per cent of the total is carried by each newspaper; and (d) the per cent of newspaper No. 1 over No. 2, No. 3, and No. 4. You may assume that you are preparing your statistics for newspaper No. 1 which desires to show the public how much it is in the lead.

Newspaper	Local	National	Total
No. 1	9,764,153	2,386,433	?
No. 2	5,125,330	1,322,447	?
No. 3	3,660,636	817,390	?
No. 4	1,684,536	143,976	?

56. The number of pieces of first-class mail handled by the postoffice in a certain city during the month of January was 1,461,582. This was an increase of 181,652 over January of the preceding year. What was the per cent of increase?

57. A factory has five departments with floor space as follows: Department A, 11,500 square feet; Department B, 12,800 square feet; Department C, 1,500 square feet; Department D, 11,200 square feet; Department E, 21,000 square feet. What per cent of the total space does each department occupy?

58. Robert C. Cloud was touring over a state highway having a speed limit of 25 miles per hour. Tuesday morning at ten o'clock his speedometer registered 9,512.5 miles; at eleven o'clock it registered 9,549.3 miles; and at twelve o'clock it registered 9,589.3 miles. You are to show (a) the per cent of mileage over the legal speed limit during the first hour, (b) the per cent over the legal speed limit during the second hour, and (c) what was the per cent of increase for the second hour compared with the speed traveled during the first hour?

59. C. H. Penrod, salesman for the Acme Manufacturing Company, received $9,426.87 as his salary and commission for a certain year. His salary was paid to him in monthly installments of $500, and his commission was paid at the end of the year. He received a commission of $7\frac{1}{2}\%$ on his sales. (a) What was the amount of his sales, and (b) what was the amount of commission collected at the end of the year?

60. The distance from New York to Buffalo is 438.73 miles; from Buffalo to Cleveland 183.2; from Cleveland to Toledo, 113.5 miles; and from Toledo to Chicago, 254 miles: (a) what is the distance between New York and Chicago; (b) what per cent of the total distance is the distance from Chicago to Toledo; (c) what per cent of the total distance is the distance from Cleveland to Toledo?

61. The following bargain advertisement appeared in one of the newspapers of a certain city, "Fur coats at a saving of 25% to 40%":

a. $100 coats for $65
b. $135 coats for $115
c. $175 coats for $125
d. $295 coats for $195
e. $195 coats for $125
f. $225 coats for $165
g. $235 coats for $175
h. $150 coats for $120

You are to determine (a) which of these reductions are in accordance with the advertisement, and (b) ascertain the percentage of reduction based on the original marked price. If the merchant sells one each of these coats at the bargain price advertised, (c) what would be the per cent of reduction on the whole sale based on the original marked price.

62. The following appeared in a bargain rug advertisement, "$16.75 rugs for $13.40". If these rugs cost the merchant $11.64 per rug, what was the per cent of profit: (a) on the original marked price; (b) on the bargain price?

63. The following statement appeared in a bargain advertisement, "Inlaid linoleum, $1.49 per yard, a reduction of 15%". (a) What was the original selling price? (b) If the linoleum cost $1.18 a yard what per cent of profit was made on the original selling price? (c) What was the per cent of profit on the bargain price?

64. A merchant received a check from one of his customers for $1,860.24, marked "In full of account". According to the terms of the sale, the customer was to have $2\frac{1}{2}\%$ discount if he paid the bill within ten days, and the check was received within this period. What was the amount of the sale for which this check was in payment?

65. The four salesmen for the Cramer Manufacturing Company made the following number of calls during the month of January: A. L. Coats, 101; D. C. Mayo, 126; J. J. Marshall, 112; and R. T. Downing, 118. (a) What was the total number of calls made by the four salesmen? (b) What per cent of the total calls was made by each salesman?

66. Mary Browne, a clerk in the Busy Bee Department store received a bonus of 2% on all of her sales, and 5% of the sales she made each day in excess of $50. Her sales for the week were as follows: $51.28, $45.68, $49.23, $59.04, $61.02, $71.03. What amount of bonus did she receive for the week?

CHAPTER XVII

INTEREST

The term *interest* is used to describe the income derived from money loaned or the cost incurred by the use of money which has been borrowed. The one who uses the money pays for its use, hence the interest is a cost or an expense to him, and an income to the lender.

The amount borrowed or the amount on which the interest is calculated, is known as the *principal.* The per cent of the principal to be paid each year for the use of money is known as the *rate.* The *time* is the number of days, months, or years during which the money is used. The rate is based on one year, but if the borrower uses the money for more or less than a year, the amount of interest paid will be proportionally more or less.

The rate is controlled by the state law. By referring to the table on the next page, you will see the effect of the laws in the various states on interest rates. When a definite rate is fixed by state law, this is referred to as the *legal rate,* and is the rate to be applied when no other rate has been contracted. Some states allow a contract rate greater than the legal rate, but other states permit the legal rate only. Collecting more than the legal rate as interest is referred to as *usury.*

Interest calculations require the percentage application of decimal fractions with the rate based on one year. If Robert Jones, a salesman, is to receive 6% of the sales he makes as a compensation, this means that his income is .06 of his sales, or 6c on each dollar. If his income is 6% on money loaned, he will receive .06 of the amount loaned, or 6c on each dollar for each year it is used by one to whom it is loaned. The calculations necessary to arrive at the compensation are the same in each case, provided the money loaned is used by the borrower for a full year. If the borrower uses the money for less than a year, the compensation for its use will be less.

Interest Rates in the Various States

States and Territories	Legal rate Per cent	Contract rate Per cent	States and Territories	Legal rate Per cent	Contract rate Per cent
Alabama	8	8	Montana	8	10
Alaska	8	12	Nebraska	7	10
Arkansas	6	10	Nevada	7	12
Arizona	6	10	N. Hampshire	6	Any rate
California	7	12	New Jersey	6	6
Colorado	8	12	New Mexico	6	10
Connecticut	6	12	New York	6	6
Delaware	6	6	North Carolina	6	6
Dist. of Col.	6	8	North Dakota	6	9
Florida	8	10	Ohio	6	8
Georgia	7	8	Oklahoma	6	10
Hawaii	8	12	Oregon	6	10
Idaho	7	10	Pennsylvania	6	6
Illinois	5	7	Porto Rico	6	12
Indiana	6	8	Rhode Island	6	Varies
Iowa	6	8	South Carolina	7	8
Kansas	6	10	South Dakota	7	10
Kentucky	6	6	Tennessee	6	8
Louisiana	5	8	Texas	6	10
Maine	6	Any rate	Utah	8	12
Maryland	6	6	Vermont	6	6
Massachusetts	6	Any rate	Virginia	6	6
Michigan	5	7	Washington	6	12
Minnesota	6	8	West Virginia	6	6
Mississippi	6	8	Wisconsin	6	10
Missouri	6	8	Wyoming	7	10

When interest is calculated on the principal for the time the principal has been used, it is known as *simple interest.* When the contract provides that the interest at the end of a definite period may be added to the principal and the interest during the next period calculated on this new principal, it is known as *compound interest.* The usual plan in long time loans is for the borrower to pay simple interest on the loan at definite dates, rather than to compound the interest and increase the principal.

The method of calculating both simple and compound interest is the same in that the principal is multiplied by the rate expressed as a decimal fraction, the product being the interest for one year. In simple interest calculations the principal remains the same, but in compound interest calculations the principal increases at the beginning of stated periods due to the addition of interest.

EXERCISE No. 154, INTEREST AT 6% FOR ONE OR MORE MONTHS

A year is 12 months, hence interest for 1 month is for $\frac{1}{12}$ of a year; for 14 months, $\frac{1}{6}$ more than a year; 2 years and 9 months, $2\frac{3}{4}$ times that for one year. Contract or custom may affect the interpretation of "month" in interest calculations but unless governed by contract or special conditions, a month is usually regarded as one twelfth of a year.

The following problems provide oral practice in interest calculations based on the rate of 6% for one year of 12 months, each month being considered as equivalent to one twelfth of a year.

	1	2
a.	\$400.00 for 3 months	\$2,500.00 for 15 months
b.	250.00 for 6 months	2,200.00 for 12 months
c.	100.00 for 3 months	2,000.00 for 3 months
d.	600.00 for 2 months	3,000.00 for 3 months
e.	500.00 for 4 months	4,000.00 for 4 months
f.	750.00 for 12 months	5,000.00 for 5 months
g.	60.00 for 6 months	6,000.00 for 3 months
h.	150.00 for 4 months	1,500.00 for 12 months
i.	350.00 for 12 months	4,000.00 for 6 months
j.	90.00 for 6 months	5,000.00 for 7 months
k.	80.00 for 3 months	2,000.00 for 2 months
l.	75.00 for 4 months	8,000.00 for 2 months

EXERCISE No. 155, INTEREST AT 6% FOR ONE OR MORE MONTHS

The following problems provide written practice in interest calculations with the rate at 6% for a year, each year consisting of 12 months, each month regarded as one twelfth of a year. The illustration below shows the method of calculating the interest on \$581.65 for 3 months at 6%.

\$581.65
.06
4)34.8990
8.7247

The principal is multiplied by .06 giving a product of 34.8990 which is the interest for one year; since three months is $\frac{1}{4}$ of a year, dividing the interest for one year by 4 gives a quotient of 8.7247 or \$8.72, the interest for three months; had the two figures at the right been 50 or more, the interest would have been \$8.73.

	1	2
a.	$315.45 for 3 months	$5,123.45 for 14 months
b.	591.15 for 6 months	2,145.65 for 9 months
c.	675.35 for 3 months	8,125.55 for 6 months
d.	723.85 for 4 months	3,456.75 for 8 months
e.	225.85 for 2 months	4,567.25 for 3 months
f.	645.50 for 4 months	6,024.35 for 7 months
g.	765.80 for 2 months	9,210.10 for 1 month
h.	217.85 for 1 month	1,245.90 for 2 months
i.	355.65 for 2 months	5,216.75 for 5 months
j.	129.75 for 12 months	3,150.85 for 6 months
k.	875.65 for 10 months	1,750.25 for 9 months
l.	432.25 for 11 months	5,500.15 for 12 months

EXERCISE No. 156, INTEREST FOR ONE OR MORE MONTHS

When the rate is more or less than 6%, the amount of interest is ascertained in the same manner as when it is 6%; that is, the principal is multiplied by the rate to ascertain the interest for one year, and the interest for one year used as a basis for ascertaining the interest for the number of months the principal has been used.

The following problems provide oral practice in ascertaining the interest when the principal, the rate, and the number of months are given.

	1	2
a.	$300, 4 mos., 5%	$2,000, 8 mos., 5%
b.	500, 6 mos., 4%	3,000, 7 mos., 5%
c.	300, 2 mos., 7%	5,000, 5 mos., 5%
d.	800, 3 mos., 8%	1,000, 9 mos., 9%
e.	60, 6 mos., 7%	2,000, 2 mos., 8%
f.	900, 1 mo., 8%	6,000, 6 mos., $4\frac{1}{2}$%
g.	100, 6 mos., 9%	2,000, 2 mos., 8%
h.	200, 8 mos., 7%	3,000, 5 mos., 7%
i.	300, 3 mos., 3%	2,000, 8 mos., 7%
j.	800, 4 mos., $4\frac{1}{2}$%	9,000, 9 mos., 4%
k.	700, 3 mos., 7%	2,500, 27 mos., 4%
l.	36, 6 mos., 5%	2,000, 11 mos., 5%

EXERCISE No. 157, INTEREST FOR ONE OR MORE MONTHS

The following problems provide written practice in interest calculations when the principal, rate, and time in months are given; each year consisting of 12 months, and each month being $\frac{1}{12}$ of a year. The illustration below shows the method of calculating the interest on $581.65 for 3 months at 7%.

$$\begin{array}{r} \$581.65 \\ .07 \\ \hline 4)40.7155 \\ \hline 10.1788 \end{array}$$

The principal is multiplied by .07 giving a product of 40.7155 which is the interest for one year; dividing this by 4 gives a quotient of 10.1788 or $10.18, the interest for 3 months.

In all interest calculations carry the operations to four decimal places before discarding the remainders.

	1	2
a.	$565.15, 6 mos., 5%*	$1,250.75, 7 mos., 5%
b.	75.65, 3 mos., 7%	3,475.95, 2 mos., 9%
c.	323.50, 7 mos., 8%	5,432.10, 3 mos., 7%
d.	439.65, 1 mo., 9%	6,125.50, 7 mos., 4%
e.	786.15, 6 mos., 7%	4,050.25, 6 mos., 8%
f.	435.80, 1 mo., 4½%	2,254.35, 1 mo., 4½%
g.	219.55, 3 mos., 5%	6,250.85, 4 mos., 7%
h.	398.95, 4 mos., 7%	4,125.65, 5 mos., 9%
i.	456.65, 5 mos., 8%	4,450.55, 2 mos., 7%
j.	275.50, 7 mos., 3%	3,130.30, 3 mos., 3%
k.	316.25, 8 mos., 7%	5,300.75, 5 mos., 5%
l.	599.50, 6 mos., 4%	4,198.45, 6 mos., 4%

*NOTE: If desired, the interest may be ascertained at 6% for the given number of months and this used as a basis for ascertaining the interest at a rate above or below 6%. If the rate is 8%, the interest would be ⅓ more than it is at 6%; 9% would be ½ more; 4½% would be ¼ less, 5% would be ⅙ less, and 7% would be ⅙ more.

EXERCISE No. 158, INTEREST AT 6% FOR DAYS

When the time is less than a year and not an exact number of months, it is expressed in days. When the money is used for a designated number of days, it is necessary to use the number of days in a year in order to ascertain the fractional part of a year the money has been used. For convenience in interest calculations, it is customary in business to regard a year as 360 days composed of 12 months of 30 days each. This means that 20 days would be $\frac{20}{360}$ or $\frac{1}{18}$ of a year; 30 days, $\frac{30}{360}$ or $\frac{1}{12}$ of a year; 60 days, $\frac{60}{360}$ or $\frac{1}{6}$ of a year; 6 days, $\frac{6}{360}$ or $\frac{1}{60}$ of a year, etc.

Applying the above reasoning to find the interest on \$200 for 90 days at 6%, the process would be as follows: the interest on \$200 for one year at 6% is 200 times .06 or \$12; 90 days is $\frac{90}{360}$ or $\frac{1}{4}$ of a year; $\frac{1}{4}$ of \$12 is \$3, the interest on \$200 for 90 days at 6%.

If \$200 were used for 40 days the interest would be $\frac{1}{9}$ of \$12, or \$1.33, because 40 days is $\frac{1}{9}$ of 360 days. If the \$200 were used for 20 days the interest would be 67c, because 20 days is $\frac{1}{18}$ of 360 days.

The following problems provide oral practice in ascertaining the interest at 6%, when the time is expressed in days, and the days are regarded as a fractional part of 360.

1	2	3
a. \$300 for 60 days	*a.* \$1,200 for 12 days	*a.* \$22 for 60 days
b. 200 for 90 days	*b.* 2,250 for 20 days	*b.* 84 for 30 days
c. 450 for 30 days	*c.* 4,500 for 40 days	*c.* 36 for 20 days
d. 450 for 40 days	*d.* 7,500 for 80 days	*d.* 95 for 6 days
e. 200 for 30 days	*e.* 2,500 for 30 days	*e.* 49 for 12 days
f. 450 for 20 days	*f.* 3,900 for 40 days	*f.* 62 for 18 days
g. 800 for 40 days	*g.* 4,200 for 80 days	*g.* 65 for 90 days
h. 250 for 90 days	*h.* 6,000 for 60 days	*h.* 80 for 30 days
i. 375 for 20 days	*i.* 6,600 for 66 days	*i.* 75 for 20 days
j. 375 for 60 days	*j.* 7,200 for 72 days	*j.* 96 for 60 days
k. 300 for 40 days	*k.* 8,000 for 80 days	*k.* 72 for 12 days
l. 375 for 60 days	*l.* 3,600 for 36 days	*l.* 13 for 40 days

EXERCISE No. 159, INTEREST AT 6% FOR DAYS

The following problems provide written practice in ascertaining the interest when the time is expressed in days and the rate is 6%. The illustration at the left shows the method of ascertaining the interest on \$282.45 for 45 days at 6%. You will show the solution of each problem in the same form as in the illustration.

\$282.45
.06
16.9470
45 days = $\frac{45}{360}$ or $\frac{1}{8}$
$\frac{1}{8}$ of 16.9470 = 2.1183
or \$2.12

The interest for one year would be .06 of \$282.45 or 16.9470 as shown in the solution at the left. 45 days is $\frac{45}{360}$ or $\frac{1}{8}$ of a year. If the interest on \$282.45 is 16.9470 for one year, for $\frac{1}{8}$ of a year, it would be $\frac{1}{8}$ of this amount or \$2.12.

1	2	3
a. $299.75, 40 days	*a.* $85.40, 54 days	*a.* $2,311.55, 6 days
b. 377.16, 30 days	*b.* 99.18, 36 days	*b.* 3,265.70, 60 days
c. 704.45, 18 days	*c.* 52.40, 90 days	*c.* 2,291.90, 45 days
d. 199.25, 36 days	*d.* 78.65, 30 days	*d.* 4,402.11, 36 days
e. 462.75, 80 days	*e.* 15.50, 120 days	*e.* 9,841.40, 90 days
f. 281.90, 90 days	*f.* 77.75, 80 days	*f.* 7,208.16, 20 days
g. 616.65, 72 days	*g.* 36.85, 40 days	*g.* 3,303.48, 60 days
h. 109.14, 90 days	*h.* 82.65, 36 days	*h.* 2,908.65, 80 days
i. 200.20, 100 days	*i.* 62.95, 72 days	*i.* 8,414.15, 40 days
j. 411.15, 45 days	*j.* 44.88, 60 days	*j.* 7,209.19, 40 days
k. 214.55, 30 days	*k.* 27.25, 150 days	*k.* 4,000.05, 60 days
l. 175.75, 40 days	*l.* 69.65, 80 days	*l.* 2,218.19, 30 days

EXERCISE No. 160, SIXTY-DAY 6% METHOD

You will have observed from the calculations required in the interest problems given in the preceding exercises that the interest for 60 days at 6%, is $\frac{1}{100}$ of the principal, and for 6 days, $\frac{1}{1000}$ of the principal. The reason for this is because 60 days is $\frac{1}{6}$ of a year and multiplying the principal by $\frac{6}{100}$ and dividing by 6 is equivalent to dividing the principal by 100. 6 days is $\frac{1}{10}$ of 60 days, hence the interest for 6 days is $\frac{1}{10}$ of that for 60 days or $\frac{1}{1000}$ of the principal. Many interest calculations may involve a number of days which is not conveniently expressed as a fraction of a year, but which can be more conveniently expressed as a fraction of 60 days; and since the interest for 60 days is known without any calculations, it is advisable to use the 60 days as a basis for the fraction, instead of 360 days.

Applying the above reasoning to ascertain the interest on $300 for 30 days at 6%, the process would be as follows: the interest on $300 for 60 days is $3; 30 days $= \frac{30}{60}$ or $\frac{1}{2}$ of 60 days; if the interest on $300 for 60 days is $3 and 30 days is $\frac{1}{2}$ of 60 days, the interest on $300 for 30 days is $1.50.

To find the interest on $200 for 42 days the process would be as follows: the interest on $200 for 60 days is $2; 42 days $= \frac{42}{60}$ or $\frac{7}{10}$ of 60 days; $\frac{7}{10}$ of $2 = $1.40.

To find the interest on $500 for 48 days the process would be as follows: the interest on $500 for 60 days is $5; 48 days $= \frac{48}{60} = \frac{4}{5}$; $\frac{4}{5}$ of $5 is $4, the interest on $500 for 48 days.

The following problems provide oral practice in ascertaining the interest at 6%, basing your calculations on the interest for 60 days which is ascertained by moving the decimal point two places to the left. If the time is less than 60 days, the interest will be proportionately less, and if more than 60 days the interest will be proportionately more.

1	2	3
a. $100 for 30 days	*a.* $450 for 66 days	*a.* $ 25 for 24 days
b. 150 for 45 days	*b.* 300 for 72 days	*b.* 35 for 36 days
c. 200 for 20 days	*c.* 400 for 80 days	*c.* 40 for 42 days
d. 300 for 40 days	*d.* 200 for 84 days	*d.* 75 for 36 days
e. 500 for 45 days	*e.* 900 for 90 days	*e.* 45 for 60 days
f. 300 for 36 days	*f.* 400 for 75 days	*f.* 100 for 40 days
g. 150 for 42 days	*g.* 600 for 85 days	*g.* 60 for 48 days
h. 300 for 12 days	*h.* 150 for 96 days	*h.* 48 for 72 days
i. 400 for 24 days	*i.* 250 for 66 days	*i.* 72 for 36 days
j. 800 for 30 days	*j.* 300 for 72 days	*j.* 36 for 42 days
k. 250 for 60 days	*k.* 750 for 75 days	*k.* 24 for 66 days
l. 350 for 36 days	*l.* 250 for 78 days	*l.* 42 for 30 days

EXERCISE No. 161, SIXTY-DAY 6% METHOD

When the time is more than sixty days, the interest for the additional days is found by separating the additional days into aliquot parts of sixty, and taking such fractional part of the interest for sixty days as the number of days bears to sixty days. If the time is less than sixty days, the interest is found for the required number of days, using the interest for sixty days as a basis. The illustration below shows the method of ascertaining the interest on $726.48 at 6% for 85 days.

$726.48—85 days

7.2648 = int. for 60 days
2.4216 = int. for 20 days
.6054 = int. for 5 days

10.2918 = int. for 85 days
or $10.29

The interest for 60 days is ascertained by moving the decimal point two places to the left. The interest for 20 days is $\frac{2}{6}\frac{0}{0}$ or $\frac{1}{3}$ of that for 60 days; and the interest for 5 days is $\frac{5}{6}\frac{}{0}$ or $\frac{1}{1}\frac{}{2}$ of that for 60 days. The interest on the given principal for 85 days at 6% is $10.29, which is equal to the interest on this principal for 60 days, plus 20 days, plus 5 days. A fraction of a cent is considered until the final result is obtained. At that time it is regarded as a whole cent, if one half or more, and discarded if less than one half of a cent.

The following problems provide written practice in ascertaining the interest at 6% on a given principal for a given number of days, based on the interest for sixty days.

This method is sometimes referred to as the "sixty-day method", which may be interpreted to mean that the interest for sixty days is used as a basis for ascertaining the interest for a given number of days. You are to show on tablet paper the calculations necessary to arrive at the desired interest arranged in the same form as in the illustration. Any fractional values desired may be used; thus, in the illustration 15 days ($\frac{1}{4}$) and 10 days ($\frac{1}{6}$) could have been used instead of 20 days ($\frac{1}{3}$) and 5 days ($\frac{1}{12}$).

1	2	3
a. $327.48, 45 days	*a.* $154.55, 99 days	*a.* $205.48, 16 days
b. 357.55, 30 days	*b.* 116.42, 120 days	*b.* 39.87, 98 days
c. 518.42, 15 days	*c.* 314.50, 75 days	*c.* 215.40, 95 days
d. 721.19, 20 days	*d.* 921.90, 125 days	*d.* 415.55, 77 days
e. 214.55, 12 days	*e.* 614.50, 77 days	*e.* 211.11, 12 days
f. 718.80, 45 days	*f.* 918.78, 79 days	*f.* 485.25, 42 days
g. 827.40, 30 days	*g.* 415.65, 92 days	*g.* 261.84, 47 days
h. 418.05, 20 days	*h.* 404.00, 96 days	*h.* 112.60, 57 days
i. 300.65, 48 days	*i.* 350.25, 98 days	*i.* 99.83, 35 days
j. 207.62, 36 days	*j.* 207.32, 88 days	*j.* 47.42, 92 days
k. 218.25, 18 days	*k.* 402.90, 91 days	*k.* 104.68, 12 days
l. 721.22, 15 days	*l.* 537.54, 45 days	*l.* 64.42, 48 days

EXERCISE No. 162, SIX-DAY 6% METHOD

The interest on any sum of money at 6% for 60 days can be ascertained by moving the decimal point two places to the left. For this reason, the interest for 6 days at 6% can be ascertained by moving the decimal point three places to the left, because 6 is one tenth of 60. To find the interest on any principal for any number of days, ascertain the interest for 6 days at 6% by moving the decimal point three places to the left; multiply this result by the quotient obtained by dividing the number of days by 6; the product is the interest on the given principal for the required number of days.

Based on the statements above, the interest on $200 for 27 days is 90c; $.200 \times 4\frac{1}{2}\ (27 \div 6) = .90$ or 90c. The interest for 6 days is .200, hence the interest for 27 days is $4\frac{1}{2}$ times that for 6 days, or 90c. The interest on $500 for 39 days is $3.25; $.500 \times 6\frac{1}{2}\ (39 \div 6) = \$3.25$.

The following problems provide oral practice in finding the interest at 6%, using the sixty-day method explained in Exercise No. 160, or the six-day method explained in the preceding paragraph. In solving the problems, use the method which you consider the shorter.

1	2	3
a. $200 for 24 days	*a.* $ 85 for 24 days	*a.* $2,000 for 27 days
b. 150 for 18 days	*b.* 550 for 48 days	*b.* 1,000 for 39 days
c. 300 for 36 days	*c.* 75 for 66 days	*c.* 3,000 for 86 days
d. 400 for 42 days	*d.* 300 for 90 days	*d.* 2,500 for 72 days
e. 50 for 45 days	*e.* 250 for 51 days	*e.* 1,500 for 66 days
f. 25 for 66 days	*f.* 99 for 48 days	*f.* 900 for 9 days
g. 375 for 24 days	*g.* 150 for 72 days	*g.* 9,000 for 72 days
h. 250 for 42 days	*h.* 500 for 78 days	*h.* 8,500 for 24 days
i. 500 for 48 days	*i.* 250 for 72 days	*i.* 5,500 for 33 days
j. 300 for 51 days	*j.* 95 for 36 days	*j.* 4,000 for 40 days
k. 450 for 57 days	*k.* 400 for 84 days	*k.* 3,000 for 44 days
l. 200 for 54 days	*l.* 350 for 60 days	*l.* 8,000 for 46 days

EXERCISE No. 163, SIX-DAY 6% METHOD

As explained in Exercise No. 162, the interest at 6% for 6 days is found by moving the decimal point three places to the left. The illustration below shows the method of ascertaining the interest on $418.25 for 78 days at 6%, by the six-day method, and the proof by the sixty-day method.

a.

78 ÷ 6 = 13

.41825 = interest for 6 days

13

$5.43725 = required interest

b.

78 days = 60 + 12 + 6

4 .1825 = interest for 60 days

.8365 = interest for 12 days

.4182 = interest for 6 days

$5 .4372 = interest for 78 days

Solution (a) shows the 6-day method, and solution (b) shows the 60-day method. According to the 6-day method, 78 is divided by 6, and the principal with the decimal point moved three places to the left is multiplied by the quotient. According to the 60-day method, the interest for 60 days is the principal with the decimal point moved two places to the left. The interest for 12 days is $\frac{1}{5}$ of the interest for 60 days, and the interest for 6 days is $\frac{1}{2}$ of the interest for 12 days. The sum of the interest for 60, 12, and 6 days is $5.44, the interest for 78 days.

The following problems provide written practice in applying the six-day method at 6% as illustrated, and proof of the calculations by the sixty-day method. You are to show the calculations necessary to ascertain the desired interest and proof.

1	2	3
a. $199.65, 51 days	*a.* $55.40, 91 days	*a.* $2,987.62, 59 days
b. 724.50, 69 days	*b.* 75.65, 38 days	*b.* 9,881.62, 49 days
c. 415.40, 33 days	*c.* 22.50, 102 days	*c.* 5,005.05, 92 days
d. 622.18, 81 days	*d.* 55.05, 78 days	*d.* 6,661.42, 17 days
e. 944.44, 21 days	*e.* 92.19, 57 days	*e.* 7,991.99, 74 days
f. 515.78, 27 days	*f.* 57.57, 45 days	*f.* 6,682.48, 65 days
g. 866.78, 99 days	*g.* 38.62, 93 days	*g.* 8,881.19, 11 days
h. 200.50, 45 days	*h.* 45.55, 87 days	*h.* 4,455.15, 95 days
i. 750.75, 84 days	*i.* 72.50, 78 days	*i.* 6,114.45, 46 days
j. 219.95, 48 days	*j.* 99.98, 96 days	*j.* 9,881.55, 39 days
k. 616.27, 18 days	*k.* 69.48, 27 days	*k.* 1,503.72, 71 days
l. 514.34, 21 days	*l.* 17.49, 49 days	*l.* 5,981.91, 95 days

EXERCISE No. 164, RATES OTHER THAN 6%

The interest on any principal is $\frac{1}{100}$ of the principal for the number of days obtained by dividing 360 by the rate. Thus the interest on any principal is $\frac{1}{100}$ of itself at:

6% for 60 days (360 ÷ 6 = 60); 8% for 45 days (360 ÷ 8 = 45);
9% for 40 days (360 ÷ 9 = 40); 10% for 36 days (360 ÷ 10 = 36);
15% for 24 days (360 ÷ 15 = 24); $4\frac{1}{2}$% for 80 days (360 ÷ $4\frac{1}{2}$ = 80);
4% for 90 days (360 ÷ 4 = 90); 5% for 72 days (360 ÷ 5 = 72).

The number of days in which the principal will produce interest $\frac{1}{100}$ of itself at a given rate, can be used to advantage at rates other than 6%. Divide 360 by the rate, move the decimal point two places to the left in the principal, and you have the interest at the given rate, for the number of days obtained by dividing.

Applying the above facts, the interest on $40 for 45 days at 8% is 40c; for 60 days it is $\frac{1}{3}$ more than 40 or 53c; and for 80 days it is two times 40c or 80c. The interest on $50 at 9% for 40 days is 50c; for 80 days, is $1; and for 20 days, is 25c. The interest on $60 at $4\frac{1}{2}$% for 80 days is 60c; for 100 days it is one fourth more than for 80 days, or 75c; and for 40 days it is one half of 60c, or 30c.

The following problems provide oral practice in ascertaining the interest on a given sum at rates other than 6%. Divide 360 by the rate, to ascertain the number of days, and move the decimal point two places to the left to ascertain the interest for this number of days. This interest will be proportionately increased, if the number of days given is more, and decreased, if the number of days given is less.

	1	2
a.	\$30 for 40 days at 9%	\$ 90 for 60 days at 10%
b.	30 for 60 days at 9%	90 for 20 days at 10%
c.	30 for 20 days at 9%	90 for 30 days at 12%
d.	75 for 80 days at 8%	48 for 72 days at 5%
e.	75 for 45 days at 8%	48 for 36 days at 5%
f.	75 for 30 days at 8%	48 for 18 days at 5%
g.	75 for 60 days at 8%	48 for 90 days at 5%
h.	75 for 90 days at 8%	48 for 144 days at 5%
i.	80 for 80 days at 4½%	200 for 60 days at 4½%
j.	80 for 40 days at 4½%	200 for 80 days at 4½%
k.	80 for 100 days at 4½%	200 for 100 days at 4½%
l.	90 for 80 days at 12%	200 for 60 days at 4½%

EXERCISE No. 165, RATES OTHER THAN 6%

The illustration below shows the method of ascertaining the interest on \$128.65 for 65 days at 8%. This is the same process as used in the oral solution of problems in the preceding exercise.

65 = 45 + 15 + 5

1.2865 = interest, 45 days
.4288 = interest, 15 days
.1429 = interest, 5 days

\$1.8582 = interest, 65 days

The 65 is divided into numbers, one of which is 45 and the others, factors of 45. The interest on the given principal for 45 days at 8% is one one-hundredth of the principal The interest for 15 days is ⅓ of that for 45 days, and the interest for 5 days is ⅓ of that for 15 days. The sum of these three amounts is \$1.86 which is the required interest at 8% for 65 days.

The problems at the top of page 221 provide written practice in ascertaining interest at rates other than 6% when the principal, rate and number of days are given. You are to show all the calculations necessary to find the required interest.

	1	2
a.	$429.85 for 100 days at 5%	$2,546 for 60 days at 9%
b.	98.42 for 99 days at 8%	1,758 for 150 days at 5%
c.	964.86 for 128 days at 4½%	9,500 for 225 days at 4%
d.	354.44 for 95 days at 8%	7,768 for 220 days at 4½%
e.	229.69 for 117 days at 10%	1,500 for 199 days at 5%
f.	542.37 for 115 days at 8%	3,271 for 88 days at 8%
g.	82.46 for 225 days at 8%	1,653 for 37 days at 10%
h.	723.52 for 93 days at 10%	1,005 for 55 days at 12%
i.	450.05 for 99 days at 5%	9,367 for 80 days at 8%
j.	712.33 for 66 days at 8%	1,592 for 130 days at 4½%
k.	9.65 for 125 days at 9%	1,632 for 128 days at 9%
l.	800.50 for 48 days at 10%	2,500 for 125 days at 8%

EXERCISE No. 166, RATES OTHER THAN 6%

The interest at 6% may be used as a basis for ascertaining the interest at any rate other than 6%. When this plan is followed, the interest at 6% is divided by 6 to ascertain the rate at 1%, and this quotient multiplied by the given rate to ascertain the desired interest. Thus, if it is desired to ascertain the interest on $600 at 8% for 60 days, the mental process would be as follows: interest on $600 for 60 days at 6% is $6; at 1% it is $1; and at 8% it is $8. If the method given in Exercise No. 164 is used, the mental process is as follows: the interest at 8% for 45 days is $6; and the interest for 15 days more is ⅓ more than $6 or $8.

The following problems provide oral practice in ascertaining the interest on a given principal, at a given rate, for a stated time. Use the mental process first suggested, but be prepared to use the second one.

	1	2
a.	$2,400 for 60 days at 8%	$1,500 for 60 days at 4%
b.	3,600 for 66 days at 8%	3,600 for 45 days at 5%
c.	1,800 for 75 days at 5%	5,400 for 60 days at 9%
d.	1,200 for 15 days at 4½%	7,500 for 75 days at 4%
e.	3,000 for 45 days at 8%	4,200 for 30 days at 8%
f.	4,200 for 12 days at 5%	2,500 for 24 days at 9%
g.	2,400 for 72 days at 5%	3,000 for 36 days at 5%
h.	3,600 for 24 days at 9%	6,000 for 85 days at 4%
i.	3,000 for 30 days at 8%	4,000 for 80 days at 8%

EXERCISE No. 167, RATES OTHER THAN 6%

The solutions below show the method of ascertaining the interest on $421.60 for 69 days at 8% by one method, and the proof of the result by another method.

a.

$4.2160 = int. @ 6%, 60 days
.4216 = int. @ 6%, 6 days
.2108 = int. @ 6%, 3 days

4.8484 = int. @ 6%, 69 days
.80806 = int. @ 1%, 69 days
6.46448 = int. @ 8%, 69 days

b.

$4.2160 = int. @ 8%, 45 days
1.4053 = int. @ 8%, 15 days
.8432 = int. @ 8%, 9 days

$6.4645 = int. @ 8%, 69 days

In the solution (a) the method explained in Exercise No. 161 is used. After obtaining the interest at 6% for 69 days, this is divided by 6 in order to ascertain the interest at 1%, and the quotient multiplied by 8 to ascertain the interest at 8%. The proof, solution (b), is based on the method explained in Exercise No. 164. You will observe in solution (a) that the fraction of a cent is not discarded until the final result is obtained.

The following problems provide written practice in ascertaining the interest at rates other than 6% using the 60-day method as a basis. You are to show on tablet paper the solution of each problem by one of the two methods illustrated and the proof of the solution by the other method.

	1	2
a.	$721.65, 66 days, 7%	$3,754.75, 94 days, 4%
b.	318.54, 49 days, 5%	7,621.32, 72 days, 7%
c.	218.91, 66 days, 8%*	3,381.85, 51 days, 5%
d.	714.45, 84 days, 9%	2,216.48, 72 days, 7%
e.	216.72, 24 days, 10%	9,861.75, 99 days, 3%
f.	327.92, 44 days, 7%	2,221.25, 45 days, 4½%
g.	216.65, 55 days, 4%	8,962.75, 44 days, 4½%
h.	986.55, 55 days, 5%	6,241.45, 63 days, 5%
i.	221.25, 42 days, 9%	7,219.95, 98 days, 9%
j.	316.36, 27 days, 7½%	4,454.45, 78 days, 7%
k.	333.55, 48 days, 4%	6,666.66, 79 days, 8%
l.	919.98, 84 days, 8%	2,222.25, 18 days, 9%

*NOTE: When the rate is 8%, add ⅓ to the interest at 6%; 7½%, add ¼; ½%, deduct ¼; 3%, deduct ½, and 9%, add ½.

EXERCISE No. 168, CANCELLATION METHOD

When the rate is other than 6%, the cancellation method can sometimes be used to advantage in ascertaining the amount of interest. The interest is the quotient resulting from the principal multiplied by the number of days, multiplied by the rate, divided by 360, the number of days in a year. The illustration below shows the application of the cancellation method in ascertaining the interest on \$829.48 for 90 days at 7%.

$$\frac{207.37}{\cancel{829.48}\times\cancel{90}\times.07}{\cancel{360}\ \cancel{4}} = 207.37\times.07 = \$14.52$$

The principal, number of days, and rate are written above the line and the number of days in a year below the line. 90 is contained into 360, 4 times, hence the 90 is canceled and the 4 written below the 360. 829.48 is divisible by 4, hence the 4 is canceled and 207.37, the result obtained by dividing by 4 is written above. The numbers below the line are all canceled, hence the product of 207.37×.07 is the required interest.

The illustration at the right shows the process by the 60-day method. It is well to know both methods because sometimes the cancellation method is quicker for the solution or the proof. The result should always be proved by a different method.

\$829.48 = 8.2948 for 60 days
90 days = $\frac{90}{60}$ or $1\frac{1}{2}$
\$8.2948 × $1\frac{1}{2}$ = \$12.4422
\$12.4422 ÷ 6 = \$2.0737 interest at 1%
\$2.0737 × 7 = \$14.52 interest at 7%

The following problems provide written practice in applying the cancellation method. You will show on tablet paper the solution by the cancellation method and the proof by either the 60-day method or the 6-day method.

1	2
a. \$315.17, 55 days, 7%	*a.* \$2,356.75, 18 days, 10%
b. 221.75, 40 days, 8%	*b.* 5,566.75, 12 days, 9%
c. 598.76, 54 days, 5%	*c.* 3,789.21, 54 days, 7%
d. 665.45, 90 days, 3%	*d.* 9,482.56, 90 days, 5%
e. 432.26, 75 days, 4%	*e.* 8,521.10, 75 days, 4%
f. 850.50, 80 days, 9%	*f.* 3,134.57, 80 days, $4\frac{1}{2}$%
g. 925.35, 30 days, 3%	*g.* 6,750.25, 24 days, 3%
h. 475.65, 45 days, 7%	*h.* 4,156.30, 48 days, 9%
i. 220.50, 70 days, 9%	*i.* 7,721.13, 50 days, 8%
j. 766.66, 50 days, 5%	*j.* 1,090.80, 55 days, 7%

EXERCISE No. 169, TIME REQUIRED

In the solution of problems involving interest, it is necessary to ascertain the time the money has been in use in order to calculate the interest for its use. The time involves the number of years, months, or days between the date on which the interest begins, and the date on which it is desired to ascertain the amount of the interest. There are two methods of ascertaining the time between two given dates: (a) by subtracting the beginning date from the ending date, known as compound subtraction; and (b) by counting the actual number of days between the two dates.

The illustration below shows the method of ascertaining the time between March 16 and October 27, by compound subtraction; you will use this method only when instructed to do so.

Mo.	Da.
10	– 27
3	– 16
7	– 11

$7 \times 30 = 210$ days
$210 + 11 = 221$ days

October is the tenth month and March the third, hence it is necessary to subtract three months and sixteen days from ten months and twenty-seven days. The difference is seven months and eleven days. It is customary to regard a year as twelve months of thirty days each. In seven months there are 210 days; adding the eleven days makes a total of 221 days, the difference in time by compound subtraction.

The illustration below shows the method of ascertaining the time by counting the actual number of days between the two dates; you will use this method in solving problems, unless specifically instructed to ascertain the time by compound subtraction.

March, the first month, has thirty-one days, but the interest does not begin until the sixteenth of March, hence subtracting sixteen from thirty-one leaves a balance of fifteen days. To this is added the number of days in each of the succeeding months, and the twenty-seven days in October. The reason the time by actual count is more than by the other method is because some of the months have thirty-one days. Because of the fact that all of the months do not have the same number of days, it is customary to count the number of days as illustrated, especially when the time involved is less than a year.

Mar.	31 days
Mar.	16
	15
Apr.	30
May	31
June	30
July	31
Aug.	31
Sept.	30
Oct.	27
	225

Since the tendency in modern business is to ascertain the time by counting the actual number of days, unless otherwise instructed, your interest calculations should be based on the actual number of days.

The following problems provide oral practice in ascertaining the time between two given dates. You are to state the mental process of ascertaining the time in each problem.

1	2
a. May 10 to June 5	*a.* June 15 to July 6
b. November 6 to January 4	*b.* August 7 to September 9
c. October 7 to November 9	*c.* May 4 to May 25
d. July 1 to July 28	*d.* February 9 to February 28
e. July 16 to August 16	*e.* March 16 to April 1
f. August 16 to September 16	*f.* July 1 to July 12
g. September 16 to October 16	*g.* May 16 to May 29
h. March 1 to April 10	*h.* April 1 to May 10
i. January 5 to February 11	*i.* May 11 to June 10
j. November 9 to December 23	*j.* July 6 to August 3
k. May 18 to August 12	*k.* November 9 to June 1
l. May 12 to May 20	*l.* January 11 to February 20

EXERCISE No. 170, TIME AND INTEREST REQUIRED

When the beginning and ending dates are given, it is customary to ascertain the time between these two dates by counting the actual number of days.

The illustration below shows one method of ascertaining the interest on $425.50 from April 5 to June 13 at 6%, and the proof of this solution by another method.

		a.	*b.*
Apr.	30	$425.50 = .42550	4.2550 = int. for 60 days
Apr.	5	$69 \div 6 = 11\frac{1}{2}$	.4255 = int. for 6 days
	25	$.42550 \times 11\frac{1}{2} =$	.2127 = int. for 3 days
May	31	4.89325 or	4.8932 = int. for 69 days
June	13	$4.89	or $4.89
	69		

In solution (a) the six-day 6% method is used. The interest on the principal for six days is ascertained by moving the decimal point three places to the left. The interest for the desired number of days is ascertained by multiplying the interest for six days by $11\frac{1}{2}$.

The proof shown in illustration (b) is based on the sixty-day method. The number of days is divided into sixty, six, and three, and the interest ascertained as explained in previous exercises. You should always prove your solutions by applying two different methods.

The following problems provide written practice in: (a) ascertaining the time between two given dates; and (b) ascertaining the interest on a stated amount for this time. Use the 60-day method or the 6-day method for ascertaining the interest, and the cancellation method for proving your results.

1. $ 275.65 from June 9 to November 12 at 6%
2. 741.50 from March 3 to June 16 at 6%
3. 5,000.00 from May 15 to October 21 at 5%
4. 118.62 from November 5 to February 28 at 6%
5. 10,000.00 from March 1 to October 1 at $4\frac{1}{2}\%$
6. 12.50 from June 16 to November 3 at 6%
7. 211.11 from April 9 to October 12 at 6%
8. 2,500.00 from July 1 to January 1 at 5%
9. 44.55 from May 9 to November 9 at 6%
10. 71.75 from May 17 to June 21 at 6%
11. 2,000.00 from July 1 to November 5 at 4%
12. 416.65 from November 9 to February 16 at 8%
13. 841.45 from June 21 to August 13 at 7%
14. 402.09 from November 1 to February 6 at 9%
15. 412.55 from May 11 to August 16 at 6%
16. 724.25 from March 1 to May 1 at 8%

CHAPTER XVIII

INTEREST (Concluded)

ACCURATE OR EXACT INTEREST

As previously explained the interest for one year is ascertained by multiplying the principal by the rate expressed as a decimal fraction; the product is the interest at the given rate for one year. It is customary in business to regard a year as 360 days, thus facilitating the calculations required to ascertain the interest when the time is expressed in days, but, if desired, the actual number of days in a year may be used as a basis. Simple interest on the principal, when reckoned on the basis of 365 days to a common year, and 366 days to a leap year, is referred to as *accurate interest.*

The illustrations below show the calculations necessary to secure the interest on \$721.68 for 48 days at 6% by simple interest (at the left) and by accurate interest (at the right).

\$721.68		\$721.68
.06		.06
43.3008		43.3008
48		48
3464064		3464064
1732032		1732032
2078.4384		2078.4384
5.7734		5.6943
360)2078.4384		365)2078.4384
1800		1825
2784		2534
2520		2190
2643		3443
2520		3285
1238		1588
1080		1460
1584		1284
1440		1095

The interest on the principal for one year is the principal multiplied by the rate expressed as a decimal fraction. The interest for one day is $\frac{1}{360}$ of a year by the simple interest method and $\frac{1}{365}$ of a year by the accurate interest method. The interest for 48 days would be 48 times the interest for one day. The simpler plan is to multiply the interest for a year by 48 and divide by 360 for simple interest, or by 365 for accurate interest as in the illustrations. The simple interest is \$5.77, and the accurate interest is \$5.69. The simple interest for any number of days less than a year, is $\frac{1}{72}$ greater than the accurate interest; and the accurate interest is $\frac{1}{73}$ less than the simple interest.

When the principal has been used for a full year, the accurate interest and simple interest will be the same, but when the principal has been used for less than a year, the amount of the accurate interest will be $\frac{1}{73}$ less than the simple interest. The reason for this is because simple interest is reckoned on a basis of 360 days to a year instead of 365. This time is five days too short, and the interest is therefore $\frac{5}{365}$ or $\frac{1}{73}$ too much. When accurate interest is required, the better plan is to ascertain the simple interest and deduct $\frac{1}{73}$.

NOTE: Cancellation, as explained in Exercise No. 168, may be used when finding accurate interest by dividing by 365 for a common year, or by 366 for a leap year.

EXERCISE No. 171, ACCURATE OR EXACT INTEREST

The following problems provide written practice in ascertaining accurate interest. You will show on tablet paper: (a) the calculations necessary to find the time by counting the actual number of days; and (b) the accurate interest on the given principal and rate for this time.

1. Interest on \$1,560 at 4% from March 18 to December 9 of the same year.
2. Interest on \$960.65 at 6% from June 30 to September 20 of the same year.
3. Interest on \$5,000 at 8% from November 2 of one year to January 15 of the following year.
4. Interest on \$650 at 8% from October 14 to December 27 of the same year.
5. Interest on \$2,400.24 at $4\frac{1}{2}$% from August 23 in one year to March 20 of the following year (February, 28 days).
6. Interest on \$1,741.50 at 6% from July 29 to September 11 of the same year.
7. Interest on \$975.50 at 6% from January 3 to March 1 of the same year (February, 28 days).
8. Interest on \$800 at 5% from December 18 of one year to April 14 of the following year (February, 28 days).
9. Interest on \$22,500 from January 10 of one year up to and including July 1 of the following year at 6%.

Count the time from January 10 of one year, up to and including January 10 of the following year, as one full year; and the actual number of days of the remaining time (29 days in February) is the time for which accurate interest is computed.

EXERCISE No. 172, REVERSING THE OPERATIONS

Every mathematical operation has its reverse. Just as addition has its subtraction, multiplication its division, involution its evolution, etc., so interest has its reverse operations.

There are four elements involved in interest calculations: (a) the principal, (b) the rate, (c) the time, and (d) the interest. If any three of these elements are provided, the fourth may be obtained. The process may be explained as follows:

a. Principal × (rate for the time) = interest
b. Interest ÷ ($1 × rate for the time) = principal
c. Interest ÷ (principal × rate for 1 day) = time (in days)
d. Interest ÷ (principal × 1% for given time) = rate used

Substituting figures for the above you have:

a. $1,260 at 5% for 54 days = $9.45
b. $9.45 ÷ .007½ (interest on $1 for 54 days at 5%) = $1,260
c. $9.45 ÷ .17½ (interest on $1,260 for 1 day at 5%) = 54 days
d. $9.45 ÷ $1.89 (interest on $1,260 for 54 days 1%) = 5%

One day is used as the basis when it is desired to find the time, and $1 is used as the basis when it is desired to find the principal.

The following problems provide practice in ascertaining one of the terms when the other three are given. You are to ascertain the information required in the columns in which the question marks appear.

	Principal		Rate	Time	Interest		Amount		Proceeds	
1.	$800		7 %	4 mo., 3 days	?		?	..	...	..
2.	?		6 %	3 mo., 3 days	$ 32	55	...	..	?	..
3.	325	50	?	11 mo., 9 days	24	52	...	..	...	..
4.	4,500		4½%	?	175	50	...	..	...	..
5.	1,846	24	7½%	1 mo., 5 days	?		...	..	?	
6.	?		5 %	33 days	3	08	...	..	...	..
7.	825		?	54 days	9	90	...	..	...	..
8.	960		5 %	?	18	80	...	..	...	..
9.	?		4 %	27 days	?		752	75	...	..
10.	....	..	8 %	2 mo., 6 days	?		...	..	354	72

The *amount* is the principal plus the interest, and the *proceeds* is the principal minus the interest.

EXERCISE No. 173, COMPOUND INTEREST

When a contract specifies that the accrued interest at the end of designated periods be added to the principal, and the interest for the next period calculated on the new principal, the interest is said to be compounded and the interest, *compound interest.* The word "compound" before interest does not change its meaning but simply refers to a method of ascertaining the amount of interest. The contract will determine the length of each interest period. Thus the period may be monthly, quarterly, semi-annually, annually, etc., as the contracting parties may agree upon. The calculations below show how to ascertain the amount of interest on a $5,000 note, dated January 1, due in one year, with interest at 6% to be compounded quarterly.

Principal, the first quarter, $5,000
Interest on $5,000 for $\frac{1}{4}$ year = $75
Principal, second quarter, $5,075
Interest on $5,075 for $\frac{1}{4}$ of a year = $76.13
Principal, third quarter, $5,151.13
Interest on $5,151.13 for $\frac{1}{4}$ of a year = $77.27
Principal, fourth quarter, $5,228.40
Interest on $5,228.40 for $\frac{1}{4}$ of a year = $78.43
Amount due January 1, $5,306.83

The principal for the first quarter is $5,000, but beginning with April 1, the second quarter, it is increased by the interest on the principal for a quarter; hence during the second quarter the principal is $5,075. Beginning with July 1, the principal is increased by the interest on the principal for the second quarter, or one fourth of a year. The same plan is followed for the third and fourth quarters. You will observe that the difference between the compound and simple interest is $6.83.

The following problems provide written practice in ascertaining the amount of interest when the contract is to compound the interest at stated periods. When the period for compounding is less than a year, you may regard it as a fractional part of a year. Thus the interest for 1 month would be $\frac{1}{12}$ of the interest for a year; quarterly, $\frac{1}{4}$ of the interest for a year; semi-annually, $\frac{1}{2}$ of the interest for a year, etc.

	Principal	*Rate*	*Time*	*Compounded*
1.	$ 313.20	6%	1 year	Quarterly
2.	200.50	4%	2 years	Semi-annually
3.	1,050.00	3%	3 years	Annually

	Principal	*Rate*	*Time*	*Compounded*
4.	$ 725.80	6%	2 years	Semi-annually
5.	5,000.00	5%	1 year	Quarterly
6.	460.20	8%	1 year	Monthly
7.	10,000.00	4½%	3 years	Annually
8.	375.80	7%	1 year	Monthly
9.	1,500.00	5%	5 years	Annually
10.	10,000.00	4%	4 years	Semi-annually
11.	2,000.00	6%	2 years	Quarterly
12.	3,500.00	4½%	4 years	Annually
13.	2,000.00	6%	1 year	Quarterly
14.	186.75	6%	1 year	Quarterly
15.	20,000.00	3%	10 years	Annually

EXERCISE No. 174, COMPOUND INTEREST TABLES

The table on page 232 shows the amount of $1.00 compounded annually at 3%, 4%, 5%, 6%, 7%, 8%, and 10% for 40 years. The use of this table is illustrated below. The calculations refer to the interest on $5,000 compounded annually for a period of 5 years at 5%.

Amount of $1.00 for 5 years (see table) = 1.2762816
$5,000 × 1.2762816 = $6,381.41, the amount of $5,000 for 5 years
$6,381.41 − $5,000 = $1,381.41, the compound interest

The following problems provide practice in using the information given in the Compound Interest Table on page 232. You will arrange your calculations on tablet paper in the same order as in the illustration.

1	2
a. $ 2,500, 5 years, 6%	*a.* $25,000, 15 years, 4%
b. 1,800, 9 years, 3%	*b.* 400, 9 years, 8%
c. 100, 20 years, 8%	*c.* 3,750, 12 years, 5%
d. 500, 6 years, 7%	*d.* 450, 4 years, 10%
e. 30,000, 40 years, 8%	*e.* 7,000, 5 years, 5%
f. 9,500, 8 years, 4%	*f.* 2,250, 12 years, 6%
g. 2,100, 7 years, 5%	*g.* 4,275, 9 years, 8%
h. 50, 31 years, 6%	*h.* 2,175, 21 years, 5%
i. 2,000, 10 years, 8%	*i.* 10,000, 10 years, 4%
j. 3,500, 7 years, 7%	*j.* 2,500, 35 years, 7%

COMPOUND INTEREST TABLE

Showing what $1.00 will amount to at compound interest, at various rates per cent in any number of years, from 1 to 40 inclusive.

Yrs.	3 Per cent	4 Per cent	5 Per cent	6 Per cent	7 Per cent	8 Per cent	10 Per cent	Yrs.
1	1.0300 0000	1.0400 0000	1.0500 000	1.0600 000	1.0700 000	1.0800 000	1.1000 000	1
2	1.0609 0000	1.0816 0000	1.1025 000	1.1236 000	1.1449 000	1.1664 000	1.2100 000	2
3	1.0927 2700	1.1248 6400	1.1576 250	1.1910 160	1.2250 430	1.2597 120	1.3310 000	3
4	1.1255 0881	1.1698 5856	1.2155 063	1.2624 770	1.3107 960	1.3604 890	1.4641 000	4
5	1.1592 7407	1.2166 5290	1.2762 816	1.3382 256	1.4025 517	1.4693 281	1.6105 100	5
6	1.1940 5230	1.2653 1902	1.3400 956	1.4185 191	1.5007 304	1.5668 743	1.7715 610	6
7	1.2298 7387	1.3159 3178	1.4071 004	1.5036 303	1.6057 815	1.7138.243	1.9487 171	7
8	1.2667 7008	1.3685 6905	1.4774 554	1 5938 481	1.7181 862	1.8509 302	2.1435 888	8
9	1.3047 7318	1.4233 1181	1.5513 282	1.6894 790	1.8384 592	1.9990 046	2.3579 477	9
10	1.3439 1638	1.4802 4428	1.6288 946	1.7908 477	1.9671 514	2.1589 250	2.5937 425	10
11	1.3842 3387	1.5394 5406	1.7103 394	1.8982 986	2.1048 520	2.3316 390	2.8531 167	11
12	1.4257 6089	1.6010 3222	1.7958 563	2.0121 965	2.2521 916	2.5181 701	3.1384 284	12
13	1.4685 3371	1.6650 7351	1.8856 491	2.1329 283	2.4098 450	2.7196 237	3.4522 712	13
14	1.5125 8972	1.7316 7645	1.9799 316	2.2609 040	2.5785 342	2.9371 936	3.7974 983	14
15	1.5579 6742	1.8009 4351	2.0789 282	2.3965 582	2.7590 315	3.1721 691	4.1772 482	15
16	1.6047 0644	1.8729 8125	2.1828 746	2.5403 517	2.9521 638	3.4259 426	4.5949 730	16
17	1.6528 4763	1.9479 0050	2.2920 183	2.6927 728	3.1588 152	3.7000 181	5.0544 703	17
18	1.7024 3306	2.0258 1652	2.4066 192	2.8543 392	3.3799 323	3.9960 195	5.5599 173	18
19	1.7535 0605	2.1068 4918	2.5269 502	3 0255 995	3.6165 275	4.3157 011	6.1159 390	19
20	1.8061 1123	2.1911 2314	2.6532 977	3.2071 355	3.8696 845	4.6609 571	6.7275 000	20
21	1.8602 9457	2.2787 0807	2.7859 626	3.3995 636	4.1405 624	5.0338 337	7.4002 499	21
22	1.9161 0341	2.3699 1879	2.9252 607	3.6035 374	4.4304 017	5.4365 404	8.1402 749	22
23	1.9735 8651	2.4647 1555	3.0715 238	3.8197 497	4.7405 299	5.8714 637	8.9453 024	23
24	2.0327 9411	2.5633 0417	3.2250 999	4.0489 346	5.0723 670	6.3411 807	9.8497 327	24
25	2.0937 7793	2.6658 3633	3.3863 549	4.2918 707	5.4274 326	6.8484 752	10.8347 059	25
26	2 1565 9127	2.7724 6979	3.5556 727	4.5493 830	5.8073 529	7.3963 532	11.9181 765	26
27	2.2212 8901	2.8833 6858	3.7334 563	4.8223 459	6.2138 676	7.9880 615	13.1099 942	27
28	2.2879 2768	2.9987 0332	3.9201 291	5.1116 867	6.6488 384	8.6271 064	14.4209 936	28
29	2.3565 6551	3.1186 5145	4.1161 356	5.4183 879	7.1142 571	9.3172 749	15.8630 930	29
30	2.4272 6247	3.2433 9751	4.3219 424	5.7434 912	7.6122 550	10.0626 569	17.4494 023	30
31	2.5000 8035	3.3731 3341	4.5380 395	6.0881 006	8.1451 129	10.8676 694	19.1943 425	31
32	2.5750 8276	3.5080 5875	4.7649 415	6.4533 867	8.7152 708	11.7370 830	21.1137 768	32
33	2.6523 3524	3.6483 8110	5.0031 885	6.8405 899	9.3253 398	12.6760 496	23.2251 544	33
34	2.7319 0530	3.7943 1634	5.2533 480	7.2510 253	9.9781 135	13.6901 336	25.5476 699	34
35	2.8138 6245	3.9460 8899	5.5160 154	7.6860 868	10.6765 815	14.7853 443	28.1024 369	35
36	2.8982 7833	4.1039 3255	5.7918 161	8.1472 520	11.4239 422	15.9681 718	30.9126 805	36
37	2.9852 2668	4.2680 8986	6.0814 069	8.6360 871	12.2236 181	17.2456 256	34.0039 486	37
38	3.0747 8348	4.4388 1345	6.3854 773	9.1542 524	13.0792 714	18.6252 756	37.4043 434	38
39	3.1670 2698	4.6163 6599	6.7047 512	9.7035 075	13.9948 204	20.1152 977	41.1447 778	39
40	3.2620 3779	4.8010 2063	7.0399 887	10.2857 179	14.9744 578	21.7245 215	45.2592 556	40

EXERCISE No. 175, INSTALLMENT PAYMENTS

When merchandise is sold on the installment plan, the purchaser pays a part of the purchase price when the sale is made and the remainder in equal installments, usually payable monthly. It is customary to collect interest on the unpaid balance at the time each monthly payment is collected. This has the same effect as compound interest and permits the merchant to secure compensation for the use of his money monthly, instead of waiting until the contract ends.

July 1, J. C. Shook purchased a piano from the Star Piano Company for $900. He paid $300 cash and is to pay the balance in monthly installments of $100 with interest at 6%. This means that Mr. Shook will pay 6% interest on the amount of money due the Star Piano Company for the time he is using it, paying the interest on the first of each month.

The payments for this piano when the account is closed on January 1 of the following year will appear as follows:

Due, July 1, $600
Interest for July on $600 = $3
August 1, Due, $603
August 1, received Cash, $103
Interest for August on $500 = $2.50
September 1, Due, $502.50
September 1, received Cash, $102.50
Interest for September on $400 = $2
October 1, Due, $402
October 1, received Cash, $102
Interest for October on $300 = $1.50
November 1, Due, $301.50
November 1, received Cash, $101.50
Interest for November on $200 = $1
December 1, Due, $201
December 1, received Cash, $101
Interest for December on $100 = $0.50
January 1, Due, $100.50
January 1, received Cash, $100.50

NOTE: Each month is treated as 30 days and the interest is calculated by the 60-day method.

The following problems provide written practice in calculating interest on deferred or installment payments.

1. March 1, The Music Shop sold Robert Downing a phonograph for $375. Mr. Downing paid $75 cash, and is to pay the balance in monthly installments of $25 with 6% interest on the balance payable on the first of the month when each monthly installment is payable. You are to show a record of the transactions with Mr. Downing as they relate to the sale of this phonograph, showing the amount of each payment.

2. May 1, J. L. Jones purchased from the Citizens Motor Car Company a used automobile for $1,000. He paid $400 cash and the balance to be paid in monthly installments of $100 with interest at 6% on the balance payable on the first of the month at the time each installment is paid. Show a record of the transactions and the amount of each payment.

3. May 12, C. C. Maynard purchased from the Doyle Realty Company a house and lot for $10,000. He paid $2,000 cash and executed sixteen notes for $500 each due November 12 and May 12 respectively in each year, and sixteen interest notes. The first interest note was due November 12 and was for interest on $8,000 at 6% for six months; the second interest note was due May 12 of the following year and was for interest on $7,500 at 6% for six months; the third interest note was due on the following November 12, and was for interest at 6% on $7,000 for six months. The other interest notes were for the interest due at the time of each semi-annual payment. You are to show on tablet paper all the calculations necessary to find the face of each interest note.

4. March 16, E. H. Love purchased a piano from the Baldwin Piano Company for $2,100. He paid $300 cash, and was allowed a credit of $600 on his used piano accepted in exchange. The balance was to be paid in monthly installments of $100 per month. At the time each monthly payment is paid on the piano, Mr. Love is to pay in addition to the $100, interest on the balance at 6% for one month, a month to be regarded as $\frac{1}{12}$ of a year. The first installment is to be paid on June 1, and no interest is to be charged on the balance until May 1, interest beginning on that date. Find the amount of each monthly installment.

5. June 17, O. A. Muir purchased a piano from the Wurlitzer Piano Company for $1,500. He paid $300 cash and agreed to pay the balance of $1,200 in monthly installments of $50 each. At the time he pays each monthly installment, he is also to pay interest on the balance at 6% for $\frac{1}{12}$ of a year. The first monthly installment is due August 1, at which time he pays interest for one month on $1,200. He pays the required monthly installment and interest August 1, September 1, and October 1. November 1, he pays $200 and the required interest; December 1, $150 and required interest; and January 1, the balance due on the piano

and the interest. You are to show all the calculations required to find the balance due, January 1.

6. March 1, Joseph A. Smith purchased a house and lot from the Brown Real Estate Company for $12,500. He paid $2,500 cash and executed four notes of $2,500 each due in three, six, nine, and twelve months respectively; and four notes for the interest due at 6% at the time each of the four notes is due. The contract provides that Mr. Smith can pay as much as he desires in excess of $2,500 at the maturity of any of the notes, and that proper credit is to be made on the interest notes affected. June 1, he paid the first $2,500 note, the first interest note, and $500 on the note maturing September 1. September 1, he paid the interest note due with the proper credit, the balance of the second note, and $2,000 on the third note. December 1, he paid the balance on the third note, the balance of the interest due on this note, and $2,000 on the fourth note. You are to show: (a) the amount of each of the four interest notes; (b) the amount of the credit due on the second interest note because of the excess payment on June 1; (c) the amount of the credit on the third interest note due to the excess payment, September 1; and (d) the amount of the credit on the interest note due to the excess payment, December 1; and (e) the amount paid, March 1.

NOTE: If you will prepare the eight notes, and make the credits as the payments are made, it will help you in solving this problem and others like it which occur quite frequently in business due to the deferred payment plan of selling real estate.

EXERCISE No. 176, ACCOUNTS RECEIVABLE

The merchant sells merchandise for cash and on account. A sale *on account* means that the customer to whom the merchandise is sold will pay for it either at a stated time or on the first of the following month. The *due date* of the purchase is indicated on the invoice sent to the customer at the time the merchandise is shipped or delivered to him. "Net 30 days" written after the terms indicates that the due date is 30 days from the date of the invoice; "net 60 days", that the invoice is due 60 days from the date of the invoice. If no specific time is stated in the terms, it is understood that the customer is to pay for the merchandise on the first of the following month.

A record of the sales on account to a customer and the cash received from the customer is made in account form. This account form is so arranged that sales and payments are known by their position. The illustration below shows a record of the transactions in account form with C. H. Middleton as it appears in the ledger of the Davis Manufacturing Company. The figures on the left of the double line in the center refer to sales and those on the right of the line to cash received from Mr. Middleton.

C. H. MIDDLETON

Mar.	1	30 days	$287	60	April	1	Cash	$200
Mar.	10	60 days	194	85	June	1	Cash	100
April	7	60 days	513	38	Aug.	1	Cash	300
May	2	90 days	407	20				

If Mr. Middleton wishes to pay this account in full September 1, and it is agreed that he should pay interest on past due bills, the custom is to add to the amounts on the left side of the account interest from the due date of each bill up to and including the date of settlement; and to add to the amounts on the right side interest from the date of each payment up to and including the date of settlement. The balance of the account is the difference between the total sales plus interest, and the total payments received from the customer plus interest.

Assuming that Mr. Middleton does pay this account on September 1, and that he agrees to pay interest on the past due bills at 6%, the method of finding the amount he owes is illustrated below.

Interest on $287.60 from March 31 to September 1, 154 days, is $7.38.
Interest on $194.85 from May 9 to September 1, 115 days, is $3.73.
Interest on $513.38 from June 6 to September 1, 87 days, is $7.44.
Interest on $407.20 from July 31 to September 1, 32 days, is $2.17.
Interest on $200 from April 1 to September 1, 153 days, is $5.10.
Interest on $100 from June 1 to September 1, 92 days, is $1.53.
Interest on $300 from August 1 to September 1, 31 days, is $1.55.
Total of the left side, $1,403.03, + the interest, $20.72, = $1,423.75.
Total of the right side, $600, + the interest, $8.18, = $608.18.
Balance due, September 1 = $815.57.

You will observe that the due date of a bill is ascertained by adding to the date of the invoice the number of days in which the customer is to pay the bill. In other words, the bill is past due the day after the due date.

The following problems in account form provide written practice in applying the use of interest in settling accounts. When a bill is paid within its terms it is customary not to include interest on either the bill or the payment, but when payments are made

only on account or if a bill is paid in full a week or more after it is due, the interest is considered and calculated as in the illustration.

It is not always the best policy to insist on a customer paying interest on past due bills. When the agreement is to pay interest, the plan of settlement suggested is the most satisfactory one.

1. C. J. LAWSON

Aug.	7	60 days	$185	15	Oct.	1	Cash	$200	15
Aug.	31	30 days	207	55	Nov.	1	Cash	150	75
Sept.	12	60 days	81	25	Dec.	1	Cash	300	25
Sept.	25	30 days	322	50					
Oct.	19	60 days	406	21					

Ascertain the amount due January 1, interest, 6%.

2. W. B. WIBERLING

Jan.	2	60 days	$321	20	Mar.	1	Cash	$321	20
Feb.	12	60 days	255	40	April	1	Cash	150	40
April	19	60 days	422	75	June	1	Cash	100	60
May	31	60 days	718	91	June	18	Cash	422	75
July	25	60 days	275	55	Sept.	1	Cash	350	25
Sept.	10	60 days	192	90	Oct.	1	Cash	100	60
Oct.	1	60 days	255	07	Dec.	1	Cash	100	80

Ascertain the balance due January 1, interest at 6%.

3. A. L. FIELD

July	2		$ 39	87	Aug.	1	Cash	$250	30
July	12		142	50	Sept.	1	Cash	250	50
July	20		78	91	Oct.	1	Cash	100	25
July	31		107	36	Nov.	1	Cash	100	75
Aug.	9		151	75					
Aug.	25		172	36					
Sept.	20		202	32					

It is desired to know the balance due on December 1, interest at $5\frac{1}{2}\%$, assuming that each invoice was due on the first of the following month after the sale, and interest is to be collected accordingly.

4. J. C. BARCLAY

Mar.	7	30 days	$250	15	April	6	Cash	$250	15
April	10	30 days	327	50	May	1	Cash	150	90
May	25	30 days	500	35	June	1	Cash	200	85
June	17	30 days	181	25	July	1	Cash	100	60

It is desired to know the balance due September 1, interest at 8%.

5. D. H. SCHURMAN

May	4	60 days	$ 71	56	July	1	Cash	$ 50	75
June	25	60 days	151	40	Sept.	1	Cash	100	15
July	31	60 days	192	27	Oct.	1	Cash	100	35
Sept.	9	60 days	201	21	Nov.	1	Cash	150	50
Oct.	7	60 days	89	56					

It is desired to ascertain the balance due January 1, interest at 6%.

CHAPTER XIX

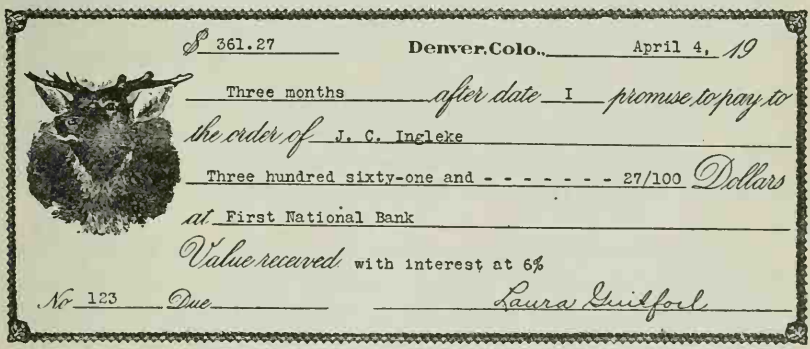
PRACTICAL PROBLEMS

The following problems provide written practice in applying the principles discussed in the preceding chapters. They include the application of the four fundamental operations in arithmetic to integers, common fractions, decimal fractions, percentage, and interest. You are to show on tablet paper all the calculations necessary to ascertain the desired results.

1. Smith Bros. owe the Regal Shoe Company $2,762.85 but cannot pay the amount now. The Regal Shoe Company agree to allow 60 days provided Smith Bros. will give them a note for an amount which when discounted at their bank at 6% will produce the balance of the account. Smith Bros. accept the proposition and execute the note on May 16. Find the face of this note.

NOTE: When no reference is made to interest in connection with a note, it is to be interpreted as a non-interest bearing note.

2. The note shown below was discounted at the First National Bank, April 27, at 8%, and the proceeds placed to the credit of Mr. Ingleke. What amount was credited to his account?



It is the usual custom with banks to count the actual number of days between the date and maturity of a note to ascertain the maturity value, and the actual number of days between the date the note was discounted and maturity, in ascertaining the discount. This note matures on a holiday, hence cannot be collected until the following day.

3. In a certain school 4% of the total number of students were absent on January 26. There were 576 students present on that day. (a) What was the total enrollment, and (b) how many students were absent?

4. Distribute $2,346.25 expenses over the following departments using the yearly sales expressed in hundred dollar units as a basis. Department A, $67,896.23; B, $55,234.89; C, $45,123.45; D, $19,456.34. The sales of the four departments are the total sales for the year.

In using $100 units as a basis, treat Department A as $67,900, Department B as $55,200, Department C as $45,100, and Department D as $19,500.

5. January 16, O. C. Barber of Huntsville, Ala., borrowed $500 from the First National Bank of Huntsville and gave in evidence of the loan an interest-bearing note due in 90 days. The note was not paid when due and legal proceedings were necessary to collect it. A judgment was awarded the First National Bank for the note and accrued interest on October 16 of the same year. What was the amount of this judgment if it was rendered for the present value of the note on that date, with legal interest from the date of the note up to and including the day the judgment was rendered, if the court costs were $27.50?

6. G. B. Dougherty paid the R. & V. Motor Car Company $2,532 for an automobile. This selling price included: (a) freight and tax, $287; and (b) the dealer's commission of 20% on the selling price of the car at the factory. (a) How much did the R. & V. Motor Car Company pay the factory for this automobile? (b) How much commission did the dealer receive? (c) What per cent of the factory price was the freight and tax?

7. An automobile tire cost $36.74 and was run 14,600 miles before it was discarded. What was the cost per mile in cents and fractions of a cent expressed in ten-thousandths?

8. November 2, C. E. Wright bought two $1,000 Inland Steel Company $5\frac{1}{2}\%$ bonds at $95\frac{1}{2}$. He sold them November 2 of the following year for $98\frac{7}{8}$. (a) How much was paid for the bonds? (b) How much was received for them when sold? (c) What was the per cent of profit on the investment?

9. A boy had $500 deposited to his credit in the Citizens Mutual Savings Bank on his tenth birthday. The bank pays $5\frac{1}{2}\%$, compounded semi-annually. What will be the amount to the young man's credit on his fifteenth birthday, the principal and interest having remained undisturbed in the bank?

10. The following commissions were paid during the business year: Brown, $189.55 first quarter, $202.10 second quarter, $197.75 third quarter, and $266.86 fourth quarter; Clark, $245.50 first quarter, $284.20, second quarter, $288.45 third quarter, $297.75 fourth quarter; Doyle, $132.20 first quarter, $128.70 second quarter, $156.35 third quarter, and $144.65 fourth quarter; Smith, $200.55 first quarter, $214 second quarter, $224.25 third quarter, $249.80 fourth quarter; Rey, $185.60 first quarter, $236.75 second quarter, $202.45, third quarter, and $110.80 fourth quarter; Jones, $257.65 first quarter, $240.25 second quarter, $308.95 third quarter, $311.30 fourth quarter. Tabulate this information so as to show: (a) each salesman's commission in each quarter; (b) total commission paid each salesman; (c) total commissions paid for each quarter; and (d) total commissions paid to all salesmen.

11. You are to ascertain the amount of the gas bill for the gas consumed; use the rates given in the schedule.

MARCH 2, 1926

No Discount Allowed on this Bill after MARCH 8

1

The J. F. Symmes Co.

109 West Vine St.

To **Union Gas & Electric Co.**, Dr.
FOURTH AND PLUM STREETS
For Gas Service:

17

Feb. 24 296000
Jan. 25 261000

Cubic Ft. Consumed 35000

RATE SCHEDULE—EFFECTIVE JUNE 1, 1925

First	5000 Cu. Ft.	@ 80c	per M Cu. Ft.
Next	5000 " "	@ 75c	" " "
"	5000 " "	@ 70c	" " "
"	5000 " "	@ 65c	" " "
"	5000 " "	@ 60c	" " "
All over	25000 " "	@ 55c	" " "

Subject to a discount of 5c per M cu ft., if paid during discount period.
Minimum Charge 80c Gross, 75c Net, per Month.

PLEASE BRING THIS BILL TO BE RECEIPTED.
OFFICE HOURS: 8 A. M. to 5 P. M.; SATURDAY to 12 M. Closed on Legal Holidays.

12. J. H. Johnson sold a house and lot to G. E. Smith for $5,500. He received cash, $3,800, the balance to be paid in

monthly installments of $100 each on the principal, plus the accrued interest at 6% on the unpaid balance. Mr. Smith was given permission to pay the full amount due on the first of any month and receive a deed for the property. He paid the balance in full when making the sixth payment. What was the amount of that payment?

You may assume that each month is $\frac{1}{12}$ of a year and the first monthly payment includes the interest on $1,700 for $\frac{1}{12}$ of a year, the second monthly payment includes the interest on the new principal for $\frac{1}{12}$ of a year, etc.

13. What will be the cost of covering a roof each side of which is 42 feet long, and 18 feet from the eaves to the ridge, at $3.75 per square of 100 square feet for the material, and $1.25 per square for labor?

14. A teacher offered a prize during the month of April, 1927, to three classes, to be awarded to the one which had the best percentage of attendance. The enrollment is as follows: Class A, 35; Class B, 31; Class C, 28. During the month of the contest Class A had 8 absentees; class B had 7 absentees; class C had 6 absentees. (a) Which class won the prize; and (b) what was the per cent of attendance in each class?

15. June 1, James Dooley purchased a home from Mayo Realty Co. for $7,000. He paid $2,500 cash and agreed to pay the balance in installments of $75 per month. The monthly payments were to include 6% interest on the balance of the principal; by agreement the interest was to be paid quarterly on July 1, October 1, January 1, and April 1. Mr Dooley was to have the privilege of paying any amount he desired in excess of $75 on July 1 and January 1. The following is a list of the payments made by Mr. Dooley: July, August, September, October, November, and December, $75 each; January, $500; February, March, April, May, and June, $75 each; July, $300; August, September, October, November, and December, $75 each; January, in full. What amounts were paid on July 1 and January 1 of each year?

16. March 6, Robert Downing purchased from Moore Bros. on 30 days time merchandise to the value of $412.85. This bill was not paid at maturity and it was necessary to bring suit to make collection. The court rendered judgment on October 12 of the same year for the amount of the claim and interest at 6% from maturity. What was the amount of the judgment, if it included court costs of $21.80?

17. How long will it take (a) $3,627.92 to produce $55.63 interest at 6%, (b) at 8%, and (c) at 4%?

18. The annual dues in a certain association are $15, and life membership dues, $150. How long must a life member live to secure his annual membership at the same rate as those who pay by the year provided money is worth 6%?

19. A. C. Clark purchased a new automobile from the Model Motor Car Company for $2,400. He paid $1,000 in cash and contracted to pay the balance in monthly installments of $200, payable on the first of each month. At the time he paid each monthly installment, he was to pay in addition to this the interest at 6% on the balance. (a) What was the amount of each monthly payment, and (b) how many months did it take him to pay the balance due?

20. A merchant lost 12% of his capital through the failure of one debtor, $7\frac{1}{2}$% of the remainder through the failure of another debtor, and had $60,500.55 left. What was his original capital?

21. The following account appears in the ledger of Roe Bros.

A. L. Robinson

Mar.	1	30 days	$137	85	Mar.	31	Cash	$137	85
Mar.	20	60 days	208	12	June	1	Cash	100	
April	10	30 days	185	16	July	1	Cash	200	
May	12	60 days	321	90	Aug.	1	Cash	100	

October 1, Mr. Robinson gave a 90-day non-interest-bearing note for an amount which when discounted at 8% would pay the balance of this account with interest at 6%. What was the face of this note?

22. J. T. Burnet owned four notes of $500 each, received by him in payment of a house and lot sold to E. H. Fagley. Each note was dated January 1, and they were due in six, twelve, eighteen, and twenty-four months respectively with interest at 6%. Mr. Fagley had the privilege of paying more than $500 at the maturity of any one of the notes. July 1, when the first note was due he paid it in full. January 1, when the second note was due, he paid it in full and $100 on the third note. July 1, when the third note was due, he paid the balance on it, and $200 on the fourth note. January 1, when the fourth note was due, he bor-

rowed sufficient money from his bank to pay the balance due Mr. Burnet. You are to show on tablet paper: (a) the amount paid at the time the first note was due; (b) the amount paid at the time the second note was due; (c) the amount paid at the time the third note was due; (d) the amount of the ninety-day note which Mr. Fagley gave to his bank to secure funds to pay the balance on the fourth note, the face of this note being for an amount which, when discounted at 8% for ninety days would produce the amount due Mr. Burnet.

23. During a business year, the facts regarding purchases and sales as recorded at the Fair Company were as follows: Beginning inventory, $8,627.92; Purchases during the year, $12,444.81; Freight cost, $867.42; Sales during the year, $21,648.55; Merchandise returned by customers, $375.80; Inventory of merchandise on hand at the end of the year, $8,221.65. (a) What was the profit on sales, and (b) the per cent of profit based on net sales?

Net sales is the gross sales less returns by customers.

24. T. A. Bauer and W. J. Smith bought an apartment house containing 21 apartments, for $175,000. They paid $75,000 cash and executed a mortgage for $100,000 payable in ten years with interest at 6%, payable July 1 and January 1 of each year. Nine of the apartments rent for $85 each per month, six, for $100 each, and six, for $125 each per month. The cost for janitor service, heating, repairs, taxes, insurance, etc., amounts to $10,225 a year. What is the net rate of income on the purchase price?

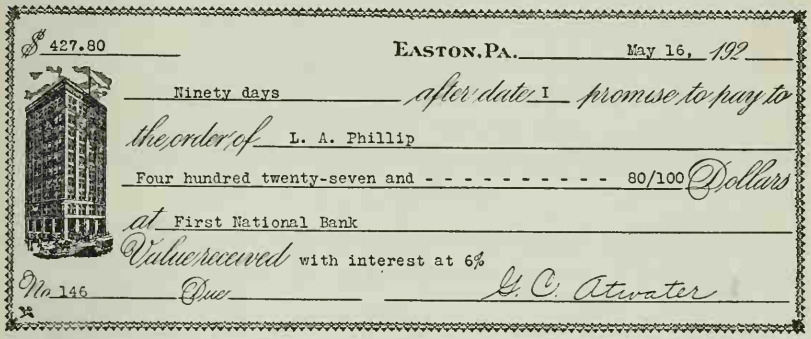
25. The Hillside Creamery, buying milk during the month of April received the following supply: R. A. Smith, 546 lbs.; H. L. Brooks, 1,595 lbs.; R. W. Downing, 2,380 lbs.; C. C. Davis, 4,540 lbs.; J. M. Jones, 3,150 lbs. The creamery paid for the milk at the rate of 32½c per pound of butter fat. In milk tests the milk was found to grade as follows: R. A. Smith, 3.96% butter fat; H. L. Brooks, 3.87%; R. W. Downing, 3.65%; C. C. Davis, 3.88%; J. M. Jones, 3.72%. (a) How much did each farmer receive, and (b) how much did the creamery pay for all the milk?

26. At the present time I am earning $2,500 a year and am living in a 3-family house paying $50 per month rent. I have been considering for some time the advisability of buying a home but have only $3,000 in available funds. I have been looking

at a house which I can buy for $6,000. The Co-operative Bank agrees to lend me the additional $3,000 at 6½%. The assessed valuation on the house and lot is $4,500; tax rate, $24 per thousand; water rate, $15 per year; and insurance on the house, $25 per year. How much will it cost me per month to own this house, allowing me 6% interest for my $3,000?

27. C. C. Carpenter presented his daughter with ten $1,000, 10-year, 5½% bonds on her tenth birthday, July 1. How much will she have at maturity of these bonds which will be her twentieth birthday, if the semi-annual interest payable July 1 and January 1 is deposited in a bank where interest at 5% compounded annually is allowed, the principal and interest remaining in the bank undisturbed until the end of the 10 years?

28. What amount will Mr. Phillip receive for note shown below if it is discounted at the First National Bank July 1 at 8%?


$427.80 EASTON, PA. May 16, 192

Ninety days after date I promise to pay to

the order of L. A. Phillip

Four hundred twenty-seven and - - - - - - - - - - 80/100 Dollars

at First National Bank

Value received with interest at 6%

No. 146 Due G. C. Atwater

29. August 6, the Miller Bros. Co. sold A. L. Jenkins merchandise for $781.65. August 10, Mr. Jenkins accepted a 90-day trade acceptance for an amount which when discounted at 6% would pay the amount of this bill less 2%. What was the face of the trade acceptance?

30. The Jones Brick Company of Oakland, California, drew a 60-day sight draft, dated August 20, on A. C. Brown of Cleveland for $375.50, balance of Brown's account. Brown accepted the draft, August 25. September 1, the Jones Brick Company discounted this draft at their bank at 8%. What were the proceeds?

31. The Daisy Manufacturing Company holds a note of C. W. Worth & Company for $2,000 due in one year from September

5, interest at 7% from date. January 1, of the next year, The Daisy Manufacturing Company sells this note to a note broker at a discount of 8%. How much was received from the broker?

32. The Lyons Company paid $3,000 for a delivery truck January 22. At the end of the first year it was depreciated 25%, the second year, 20%, and the third year, 15%. At the beginning of the fourth year it was exchanged for a new truck with an exchange allowance of $1,000. .(a) What was the amount of the depreciation; (b) the difference between the exchange value and the present value; and (c) what per cent of the cost is the difference between the present value and the exchange value?

33. J. H. Snyder purchased a radio for $350 including the cost of installation. He paid $50 cash and the balance, $25 per month on the first of each month; interest at 6% on the principal was paid in addition to the monthly payments. You are to ascertain: (a) the amount paid each month; and (b) the total cost of the radio outfit including the purchase price and interest.

34. May 12, James Slocum paid $5,400 for an automobile. He sold it on April 12 of the fourth year for $1,800. (a) What was the average monthly cost because of the depreciation? (b) What was the average monthly interest cost, money being worth 6%?

35. A bank discounted the following non-interest-bearing notes on May 2, rate of discount 6%:

	Date	Time	Face
1.	April 1	60 days	$5,000
2.	May 2	60 days	2,000
3.	April 16	90 days	1,200
4.	April 2	60 days	2,500
5.	April 28	30 days	4,000
6.	April 26	90 days	3,000
7.	April 17	30 days	5,000

You are to ascertain: (a) the discount on each note; (b) the proceeds of each note; (c) the total discount; (d) the total proceeds; and (e) the total amount to be collected at maturity.

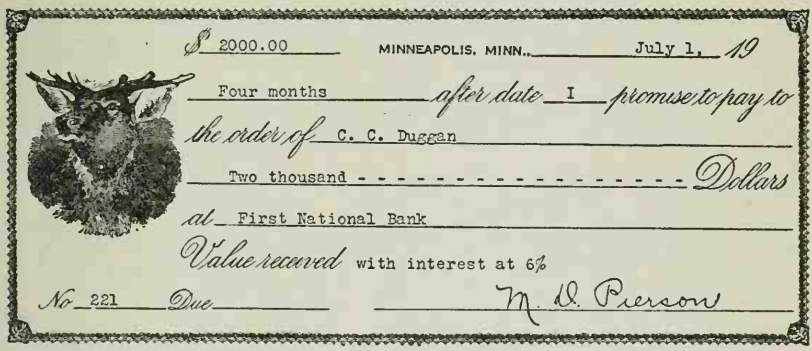
36. If the rate is $9\frac{1}{2}$% and the percentage is $126.55, what is the base?

37. If the base is \$2,521.25 and the rate is $7\frac{1}{2}\%$, what is the percentage?

38. If the base is \$1,645 and the percentage is \$451.42, what is the rate?

39. The monthly rent of the McAlpin Store is \$5,525. It is desired to distribute this over five departments on a basis of square feet as follows: Department A, 3,500 square feet; Department B, 2,500 square feet; Department C, 3,750 square feet; Department D, 1,250 square feet; Department E, 2,000 square feet. You are to ascertain the amount of rent chargeable to each of the five departments.

40. The First National Bank offered to discount this note on August 1 at 8%. The discount was to be calculated on the maturity value of the note counting the actual number of days between the date and maturity. The Citizens Bank offers to discount the note at the same rate and consider the maturity value as the face plus interest for 4 months, or $\frac{1}{3}$ of a year. You are to ascertain the proceeds of the note if discounted: (a) at the First National Bank; (b) at the Citizens Bank; and (c) the difference between the two offers.



41. December 9, the A. W. Shaw Co. sold Donaldson Bros. merchandise for \$287.38. December 12, Donaldson Bros. accepted a 60-day trade acceptance for an amount which when discounted at 8%, would pay the amount of this purchase. You are to ascertain the face of the trade acceptance.

42. The population of a certain city was 42,500 at one census period and 45,000 at the next period. (a) What was the increase of population; and (b) the per cent of increase?

43. The freight rate between two points when shipped by rail is \$1.275 per cwt. and when shipped by water, \$1.1275 per cwt. (a) What is the saving in the water rate on a shipment of 5,280 pounds; and (b) what is the per cent of saving?

44. A. L. Hodge, a traveling salesman, received \$9,876.55 as compensation for his service in a certain year. What were his total sales if he receives $7\frac{1}{2}\%$ as his commission?

45. How much would A. L. Peterson, a salesman, receive as his compensation, if he was allowed $9\frac{1}{2}\%$ on his sales and the total volume of sales during a given period was \$13,781.65?

46. James Brown borrowed from the Central Trust Company \$25,000 giving as security a mortgage on a flat building which he owned. He is to pay 5% interest semi-annually and to execute a note for the principal due in 5 years, and 10 notes each for the semi-annual interest on the entire loan. You are to ascertain: (a) the face of each interest note; and (b) the total amount of interest paid for this loan.

47. R. A. Albers purchased the property at 916 Mason Street for \$12,500. He paid \$4,500 cash and assumed a mortgage of \$8,000, with interest at 7%. The property is on the tax list at \$9,000 and the tax rate is \$27.50 per thousand. The insurance on the house is \$45 per year. If he rents the house for \$100 per month, what per cent of income will he receive on the purchase price?

48. J. J. Alderson inherits the property at 729 May Street. This property contains six apartments which rent as follows: Apartments A, B, and C, \$85 each per month; Apartments D and E. \$75 each; and Apartment F, \$65. The average expenses of maintaining the property during the past 5 years has been \$52.50 per month. What should be the market value of this property if Mr. Alderson wishes his money to earn 8%?

49. L. D. Mason paid \$10,000 cash for a farm. How much rent per year should he receive for the farm if the only expenses are the taxes of \$175.60 and he desires that his money earn $7\frac{1}{2}\%$?

50. The market quotation of corn on January 9, was $67\frac{3}{8}$c per bushel, and on February 9, $66\frac{7}{8}$c per bushel. If A. J. Jardine, a farmer, had 1,287 bushels sacked ready to sell on January 9, but held it for a higher price and finally sold it February 9 at the market quotation on that date, how much did he (a) receive for the corn; (b) lose by holding it; and (c) what was the per cent of his loss?

CHAPTER XX

BANKING AND INTEREST

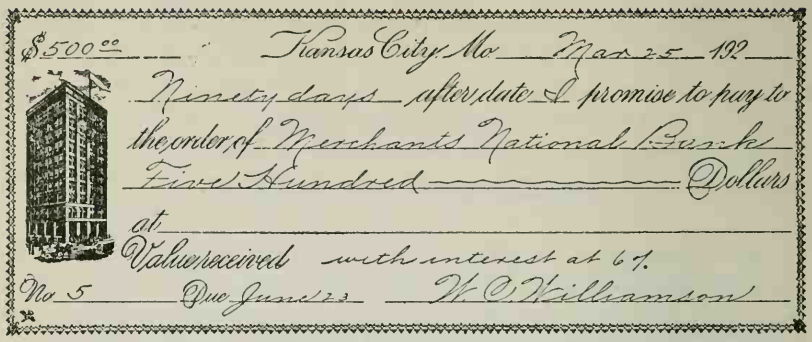
As explained in Chapter II, the principal income of a bank is the interest received for the use of the money which belongs to the bank, or to its depositors who have left it with the bank for safe-keeping. The interest earned by a bank does not differ from the interest earned by an individual; it is income earned through the use of money loaned.

The method of ascertaining the time for which the money has been used is usually the same when the money is loaned by a bank, as when it is loaned by an individual. This time is the number of days the money has been used, omitting the day on which the money is borrowed and counting the day on which it is paid or the loan renewed. Loans are made by banks for only a short time, usually 30, 60, or 90 days. Some banks collect the interest in advance, while others collect it at maturity, but this does not change the amount of the interest.

The bank will require a written evidence of a loan. This is usually in the form of a promissory note or accepted draft. A promissory note is illustrated on page 250; an accepted draft will be illustrated later.

The *face* of a note is the amount stated in it. The *maturity value* is the amount that can be collected at maturity. A note containing the words "with interest" is interest-bearing; if "with interest" is not contained in the note, it will not bear interest until after maturity. The rate of interest is determined by contract, or by the law of the state in which the note is issued; unless the rate is specified in the note, the legal rate fixed by the state applies.

The maturity value of a $500 non-interest-bearing note, dated May 23 and due in 90 days is $500 on August 21. The face value of the note up to and including August 21 is $500. If the legal rate of interest in the state in which it is executed is 6%, the face value of this note, 30 days after maturity, will be $502.50; 60 days after maturity, $505.


$500.00 Kansas City, Mo. Mar 25 192
Ninety days after date I promise to pay to
the order of Merchants National Bank
Five Hundred Dollars
at
Value received with interest at 6%.
No 5 Due June 23 W. C. Williamson

This note may be interpreted as follows: W. C. Williamson, known as the *maker*, borrowed $500 from the Merchants National Bank, the *payee*, March 25, and agreed to pay the $500 with 6% interest, 90 days from the date he borrowed it, or on June 23. This means that Mr. Williamson will pay the bank $507.50 on June 23, the $500 he borrowed, and $7.50 for its use.

The maturity value of an interest-bearing note is the face, plus the interest at maturity. An interest-bearing note bears interest to maturity at the contract rate specified in the note, and thereafter at the legal rate in the state in which it is issued.

The face of a $500, 6% interest-bearing note, dated June 10, and due in 90 days, is $500. The maturity value is $507.50, the face of the note, plus $7.50 interest.

One who wishes to borrow money should obtain it from a bank, because it is the bank's business to lend money. It is just as inconsistent to ask a friend or relative who is not in the drug business, for a loan of drugs, as it is to ask a friend or relative who is not in the banking business, for a loan of money. No higher tribute can be paid to any young man or young woman than to have an established credit at a bank, a credit which will secure a loan when needed.

Business concerns desiring a loan are given a credit rating, based on the net value of the property owned by the business, and the financial standing of the business. Member banks of the Federal Reserve System are required to have on file a financial statement from each business concern to whom they lend money similar to that in the illustration on page 251. The information in this form is secured from the accounting records of the business concern and must be correct. Should a business concern establish a credit rating with a bank on a statement which did not contain

FINANCIAL STATEMENT **To THE FIFTH-THIRD NATIONAL BANK** (Corporation)

CORPORATE NAME The Keystone Manufacturing Company

BUSINESS Manufacturers of automobiles

MAIN OFFICE Detroit, Michigan LOCATION OF PLANT Detroit, Mich.

BRANCHES Cincinnati, Ohio St. Louis, Mo.

FOR THE PURPOSE OF PROCURING CREDIT FROM TIME TO TIME WITH YOU, FOR OUR NEGOTIABLE PAPER OR OTHERWISE, WE FURNISH THE FOLLOWING AS A TRUE AND CORRECT STATEMENT OF OUR FINANCIAL CONDITION ON ..... December 31 ..... 19..... AND HEREBY AGREE TO NOTIFY YOU IMMEDIATELY IN WRITING, OF ANY MATERIALLY UNFAVORABLE CHANGE IN OUR FINANCIAL CONDITION. IN THE ABSENCE OF SUCH NOTICE OR A NEW AND FULL WRITTEN STATEMENT, THIS IS TO BE CONSIDERED AS A CONTINUING STATEMENT, AND THAT OUR PECUNIARY RESPONSIBILITY HAS NOT FALLEN BELOW THE CONDITION HEREIN SET FORTH AND IT IS HEREBY EXPRESSLY AGREED THAT UPON APPLICATION FOR ADDITIONAL CREDIT OR RENEWAL, THIS STATEMENT AND INFORMATION SHALL HAVE THE SAME FORCE AND EFFECT AS IF DELIVERED AS AN ORIGINAL REPORT OF OUR FINANCIAL CONDITION AT THE TIME SUCH ADDITIONAL CREDIT OR RENEWAL IS REQUESTED.

ASSETS			LIABILITIES		
CASH ON HAND	105 00		BILLS PAYABLE (NOTES) FOR MERCHANDISE	5 000 00	
CASH IN BANK	7 845 00		BILLS PAYABLE FOR BORROWED MONEY TO OWN BANKS		
BILLS RECEIVABLE OF CUSTOMERS, DUE WITHIN 90 DAYS	6 805 18		BILLS PAYABLE FOR BORROWED MONEY FOR PAPER SOLD		
BILLS RECEIVABLE OF CUSTOMERS, DUE BEYOND 90 DAYS	1 444 82		BILLS PAYABLE TO DIRECTORS OR STOCKHOLDERS		
ACCOUNTS RECEIVABLE, ALL GOOD, OWING FROM CUSTOMERS	23 000 00		OPEN ACCOUNTS NOT DUE	15 000 00	
MERCHANDISE, FINISHED, AT ACTUAL PRESENT CASH VALUE	20 000 00		OPEN ACCOUNTS PAST DUE		
MERCHANDISE, UNFINISHED, AT ACTUAL PRESENT CASH VALUE	20 000 00		ACCOUNTS OWING DIRECTORS OR STOCKHOLDERS		
RAW MATERIAL	18 000 00		DEPOSITS AND OTHER TRUST FUNDS		
TRADE ACCEPTANCES OWNED	2 290 00		TRADE ACCEPTANCES PAYABLE	1 107 45	
			Accrued Payroll	1 592 55	
			Accrued Interest	8 000 00	
TOTAL QUICK ASSETS	99 490 00		TOTAL CURRENT LIABILITIES	30 700 00	
STOCKS, BONDS AND INVESTMENTS			MORTGAGES AND LIENS ON REAL ESTATE DUE		
MACHINERY AND FIXTURES	98 500 00		BONDS DUE	116 000 00	
REAL ESTATE	122 500 00		CHATTEL MORTGAGES		
ACCOUNTS AND BILLS RECEIVABLE, OWING FROM OFFICERS AND EMPLOYEES			DUE TO CONTROLLED OR ALLIED CONCERNS, For Merchandise		
BILLS RECEIVABLE, OWING FROM DIRECTORS OR STOCKHOLDERS			DUE TO CONTROLLED OR ALLIED CONCERNS, For Advances		
ACCOUNTS RECEIVABLE, OWING FROM DIRECTORS OR STOCKHOLDERS	1 000 00				
DUE FROM CONTROLLED OR ALLIED CONCERNS, FOR MERCHANDISE					
DUE FROM CONTROLLED OR ALLIED CONCERNS, FOR ADVANCES					
NOTES AND ACCOUNTS RECEIVABLE, 6 MONTHS OR MORE PAST DUE	1 235 65		CAPITAL STOCK OUTSTANDING PREFERRED		
Deferred Charges	764 35		CAPITAL STOCK OUTSTANDING COMMON	150 000 00	
Goodwill	50 000 00		RESERVES — SURPLUS	12 790 00	
			RESERVES — UNDIVIDED PROFITS	40 000 00	
			RESERVES — DEPRECIATION	24 000 00	
TOTAL	373 490 00		TOTAL	373 490 00	

I HEREBY SOLEMNLY DECLARE AND CERTIFY THAT THE ABOVE IS A TRUE STATEMENT OF OUR BUSINESS.

CORPORATE NAME Keystone Manufacturing Co.

DATE SIGNED January 25 19.... BY J. W. Baker (Officers Title Must Be Given) President

NOTE—IF YOU HAVE ANY DIFFICULTY IN FILLING IN THE FOREGOING STATEMENTS AND QUESTIONARY, THE CREDIT DEPARTMENT OR ANY OTHER OFFICER OF THIS BANK IS PREPARED TO EXTEND YOU COURTEOUS AND INTELLIGENT SERVICE. IN FACT, WE SOLICIT YOUR CO-OPERATION AND ACQUAINTANCE WITH OUR CREDIT METHODS.

Financial statement submitted to a bank for financial rating.

facts, and fail to pay its obligations, the individual responsible for this incorrect statement would be subject to prosecution.

When the financial rating of a business or an individual cannot be established, or when either has borrowed in excess of the credit rating, the bank may make a loan on proper security. This security may be personal endorsement, or collateral. Personal indorsement is effected by the borrower having someone to sign with him on the face of the note or by signing his name on the back of the note. Collateral security is effected by the borrower depositing with the bank, notes, shares of stock, bonds, or other intangible property as security for the loan.

EXERCISE No. 177, MATURITY AND PRESENT VALUE

The only profit accruing to a bank through a loan of money is the interest collected at the time the loan is made or at maturity. The bank is interested in knowing (a) the maturity of the loan, and (b) the amount that will be collected at maturity, which includes the principal, and the interest if this were not included at the time the loan was made.

The maturity of a note is ascertained by adding to the date of the note, the number of days or months stated in it.

The following problems provide oral practice in determining the maturity, present value, and maturity value of a note; *present value* is the amount the borrower receives. In each of these problems it is assumed that the note is received by the bank as evidence of a loan made on the date of the note, and that when the note is interest-bearing, the borrower received the face of the note; if it is non-interest-bearing, the borrower received the face of the note less the interest at the agreed rate for the number of days stated in the note.

	Face	Date	Time	Maturity	Int. Rate	Present Value	Maturity Value
1.	$ 500.00	May 11	60 days				
2.	300.00	Mar. 6	90 days		6%		
3.	1,000.00	April 1	60 days				
4.	600.00	July 2	90 days		6%		
5.	400.00	July 19	60 days				
6.	250.00	Nov. 16	90 days				
7.	100.00	Oct. 3	90 days				
8.	9,000.00	Sept. 1	90 days				
9.	700.00	June 2	60 days		8%		
10.	500.00	May 7	90 days		6%		
11.	800.00	Oct. 3	90 days				

EXERCISE No. 178, INTEREST ON BANK LOANS

The following problems provide additional oral practice in ascertaining the amount of money a borrower will receive on the paper given to a bank as evidence of a loan. As stated in the preceding exercise, some banks collect the interest in advance, hence accept non-interest-bearing notes, while other banks collect the interest at maturity, hence accept interest-bearing notes.

1. James Brown applied to the First National Bank for a loan of $400. He was told to present his 60-day note, with interest at 6% from date, for this amount. He presented the note, May 19 and received $400 cash. When was the note due, and how much was he required to pay on the due date?

2. Robert Downing presented to the City National Bank his note for $800, dated June 17, due in 90 days, and received cash from the bank, less the interest at 8% for 90 days. (a) How much cash did he receive from the bank, (b) what was the maturity date of the note, and (c) what was the maturity value of the note?

3. W. L. Douglas applied to the Citizens National Bank for a loan of $1,000 and was told to present his note, with interest at 6%, payable in 90 days. He presented the note on November 4 and received $1,000 cash. (a) When did this note mature, and (b) what amount did he owe the bank on that date?

4. March 5, C. L. Lloyd borrowed from the Merchants National Bank $2,500 on his 90-day note. The bank gave him cash for the face of the note, less interest at 6% for 90 days. (a) How much cash did he receive, (b) when did the note mature, and (c) how much cash did he pay the bank at maturity?

5. May 27, James King borrowed $250 from the Union Trust Company on his 60-day interest-bearing note. He received $250 cash from the bank. When did this loan mature and what amount of cash did he pay the bank at maturity provided the rate of interest in the note was 9%?

6. May 17, the Union Manufacturing Company borrowed $10,000 from the Second National Bank at 5% for 90 days. They issued a note in favor of the bank for $10,000 and received cash for the difference between the face of the note and the interest agreed upon. (a) How much cash did they receive from the bank? (b) When did the loan mature?

7. D. H. Mosier borrowed $100 from the Citizens Bank and Trust Company. He gave his 30-day note payable to the bank for this amount, and received cash, less the interest for 30 days, at 8%. How much did he receive?

8. Albert Donaldson arranged with the Third National Bank for a loan of $5,000, on his 90-day note, with interest at 6%. He presented his note to the bank on May 16, and received $5,000 cash. At maturity, he paid half of the note and interest, and renewed the other half on a non-interest-bearing note due in 90 days and paid the interest in advance. (a) When was the first note due; (b) how much interest did Mr. Donaldson pay the bank at the time the second loan was made; (c) what was the amount of the new note given to renew a part of the first note; (d) how much interest did Mr. Donaldson pay on this new note; (e) how much cash did he pay the bank at the maturity of the first loan?

EXERCISE No. 179, INTEREST ON BANK LOANS

When a note is given as evidence of a loan, the borrower or maker of the note receives cash or credit for the face value, provided it bears interest. If it does not bear interest he receives cash or credit for the face of the note less the agreed interest for the time it has to run. This condition applies only when the note is given in evidence of a loan and not where a note of another is discounted at the bank.

March 13, James Brown borrowed $375.50 from the City National Bank and gave in evidence of this loan a 90-day note with interest at 8%. The calculations below show one method of ascertaining: (a) the due date, and (b) the amount Mr. Brown will pay the bank at the maturity of the note.

31 − 13 = 18	remaining days in Mar.		Face of note, $375.50	
April	30 days		3.7550	Int. 8% for 45 days
May	31 days		3.7550	Int. 8% for 45 days
June	11 days	Due date	7.5100	Int. 8% for 90 days
	90		375.50	Cash rec'd by borrower
			383.01	Maturity value

The borrower receives the face of the note, because it was interest-bearing. At maturity he pays the bank the face of the note and interest at the agreed rate. Had the borrower given a non-interest-bearing note as evidence of the indebtedness, he would have received $367.99 and paid $375.50 at maturity.

The following problems provide written practice in discounting notes. The note in each problem was given as evidence of a loan made on the date mentioned. The borrower received the face of the note, if it was interest-bearing; if non-interest-bearing, the face of the note less interest at 8% for the time.

1. Face of note, $273.50, dated March 9 for 90 days, rate of interest, 8%. Desired to know: (a) the due date; (b) amount of interest; (c) cash received by the borrower; and (d) amount due at maturity.

2. Face of note, $542.50, dated May 1 for 60 days, rate of interest, 7%. Desired to know: (a) the due date; (b) amount of interest; (c) cash received by the borrower; and (d) amount due at maturity.

3. Face of note, $85.50, dated July 1 for 120 days, rate of interest, 9%. Desired to know: (a) the due date; (b) amount of interest; (c) cash received by the borrower; and (d) amount due at maturity.

4. Face of note, $2,500, dated August 1 for 75 days, rate of interest, 5%. Desired to know: (a) the due date; (b) amount of interest; (c) cash received by the borrower· and (d) amount due at maturity.

5. Face of non-interest-bearing note, $752.65, dated March 1 for 90 days. Desired to know: (a) the due date; (b) amount of interest; (c) cash received by the borrower; and (d) amount due at maturity.

6. Face of note, $96.95, dated July 12 for 66 days, rate of interest, 8%. Desired to know: (a) the due date; (b) amount of interest; (c) cash received by the borrower; and (d) amount due at maturity.

7. Face of non-interest-bearing note, $726.25, dated March 5 for 60 days. Desired to know: (a) the due date; (b) amount of interest; (c) cash received by the borrower; and (d) amount due at maturity.

8. Face of note, $244.55, dated January 1 for 30 days, rate of interest, 8%. Desired to know: (a) the due date; (b) amount of interest; (c) cash received by the borrower; and (d) amount due at maturity.

9. Face of non-interest-bearing note, $1,500, dated March 15 for 120 days. Desired to know: (a) the due date; (b) amount

of interest; (c) cash received by the borrower; and (d) amount due at maturity.

10. Face of note, $400, dated May 7 for 120 days, rate of interest, 9%. Desired to know: (a) the due date; (b) amount of interest; (c) cash received by the borrower; and (d) amount due at maturity.

11. Face of note, $204.50, dated June 14 for 60 days, rate of interest, 7%. Desired to know: (a) the due date; (b) amount of interest; (c) cash received by the borrower; and (d) amount due at maturity.

12. Face of note, $1,200, dated May 1 for 120 days, rate of interest, 7%. Desired to know: (a) the due date; (b) amount of interest; (c) cash received by the borrower; and (d) amount due at maturity.

EXERCISE No. 180, INTEREST ON BANK LOANS

The following problems provide additional written practice in ascertaining the information needed by a bank, (a) at the time a loan is made, and (b) at maturity. Arrange your work on tablet paper in seven columns showing all the facts given below and in addition the desired facts in the columns that are blank. Use 7% in finding the present value of the non-interest-bearing notes.

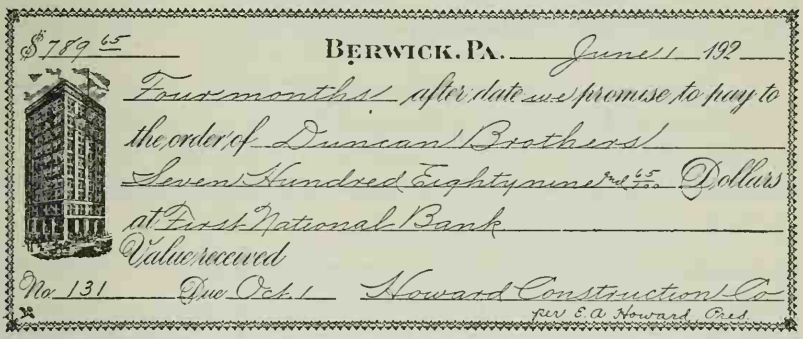
	Face	Date	Time	Maturity	Int. Rate	Present Value	Maturity Value
1.	$1,245.55	Sept. 21	30 days		6%		
2.	225.45	Nov. 15	90 days				
3.	2,110.50	May 1	60 days		5%		
4.	3,500.15	Jan. 12	90 days		8%		
5.	550.65	Mar. 15	30 days				
6.	1,035.16	June 5	60 days		6%		
7.	672.35	Aug. 16	90 days		6%		
8.	2,156.45	Sept. 12	30 days				
9.	1,123.65	Feb. 12	90 days		7%		
10.	335.15	Dec. 13	60 days				
11.	125.16	April 8	30 days		6%		
12.	3,412.76	May 11	90 days				
13.	1,444.25	Mar. 3	60 days		6%		
14.	655.75	Dec. 15	30 days				
15.	225.50	June 10	30 days				
16.	1,006.75	July 6	60 days		6%		

EXERCISE No. 181, DISCOUNTING NON-INTEREST-BEARING NOTES

It is sometimes necessary and often advisable for a merchant or manufacturer to accept notes from customers in payment of merchandise sold, or in settlement of an account, also to discount such notes at the bank. Discounting the note of another at the bank is the same process as borrowing on one's own note, except it is necessary to determine the present value of the note at a time other than the date of maturity.

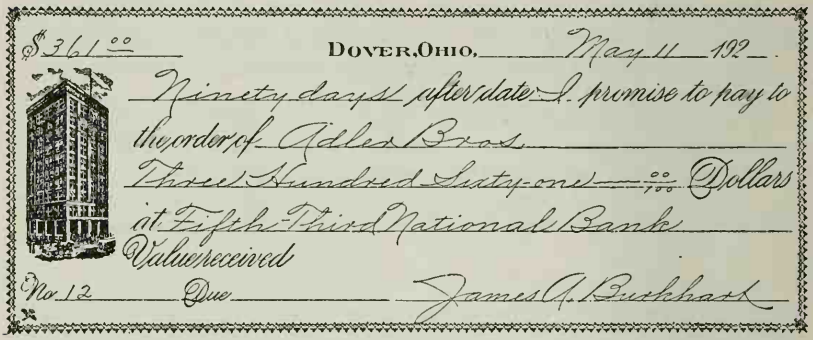
The bank receives interest for the use of its money; this interest is calculated on the amount due at maturity, and for the number of days the bank must wait to collect the loan.

Duncan Bros., wholesale hardware merchants, received from the Howard Construction Company the note illustrated below. It is desired to borrow from the City National Bank the present value of the note on July 1, less 6%. The calculations necessary to ascertain the amount of cash Duncan Bros. will receive from the bank as a loan on this note are given below the note.

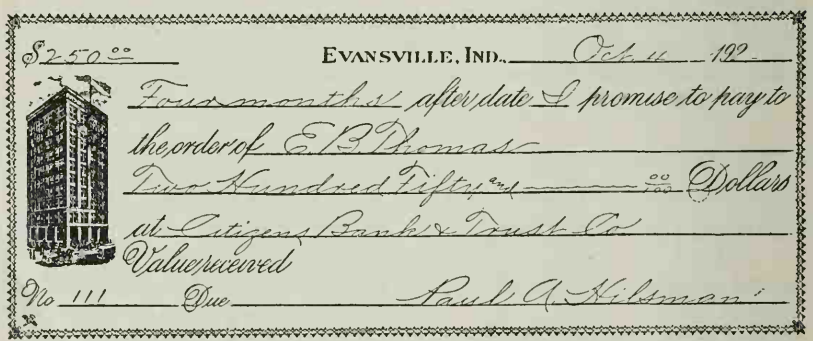


Amt. due at maturity, Oct. 1,	$789.65	The note does not bear interest, hence only the face value can be collected at maturity. The number of days between July 1 and October 1 is ascertained by counting the actual number of days as in previous exercises. The amount due at maturity, less 6% interest from the date of discount to the date of maturity is the present value of the note, which is the amount Duncan Bros. will receive in cash or have credited to their account.
Time from July 1 to Oct. 1, 92 da.		
6% Int. on $789.65 for 92 days,	12.11	
Present value of note July 1,	$777.54	

The notes illustrated on this and the following pages provide problems for written practice in ascertaining the present value of a non-interest-bearing note which is discounted at a date subsequent to the date of the note. The present value of the note in each case will be the face, less the interest for the number of days between the discount date and the maturity date. You are to show on tablet paper the calculations necessary to ascertain the desired information in each note, arranging your work in the same order as illustrated on page 257.


$361.00 DOVER, OHIO, May 11 19—.
Ninety days after date I promise to pay to
the order of Adler Bros.
Three Hundred Sixty-one 00/100 Dollars
at Fifth-Third National Bank
Value received
No. 12 Due James A. Buckhart

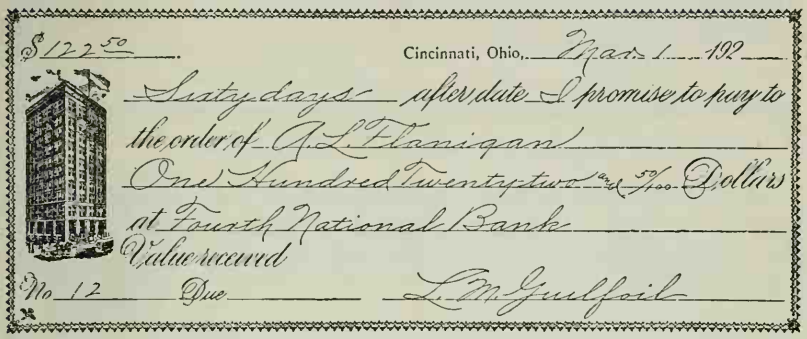
1. You are to ascertain the amount of credit received by Adler Bros. if this note was discounted on (a) June 16, less 8% discount, (b) July 1, less 7% discount, or (c) July 15, less 6% discount. The maturity date of this note is 90 days after May 11, counting the actual days.


$250.00 EVANSVILLE, IND., Oct. 4 19—
Four months after date I promise to pay to
the order of E. B. Thomas
Two Hundred Fifty 00/100 Dollars
at Citizens Bank & Trust Co.
Value received
No. 111 Due Paul A. Kilsman

2. You are to ascertain the amount of cash received by Mr. Thomas if this note was discounted at the bank on (a) Decem-

ber 1, less 6% discount; (b) December 24, less 7% discount, or (c) January 6, less 8% discount.

A note due 4 months after date is due on the same day of the fourth month after the one in which it is dated.


$122.50 Cincinnati, Ohio, Mar. 1 192

Sixty days after date I promise to pay to the order of A. L. Flanigan

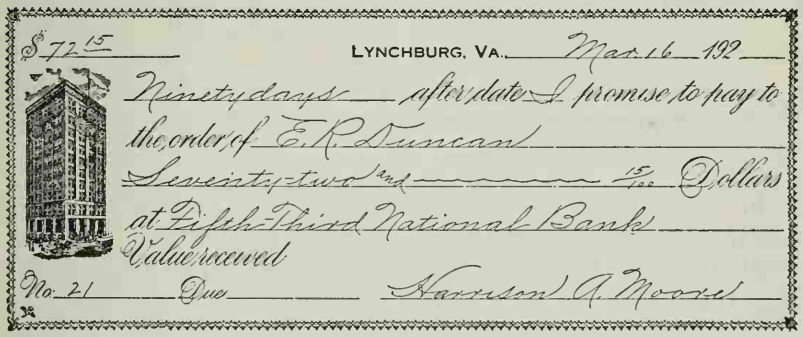
One Hundred Twenty-two 50/100 Dollars

at Fourth National Bank

Value received

No. 12 Due L. M. Gulfoil

3. You are to ascertain the amount of cash received by Mr. Flanigan if this note was discounted at the bank on (a) March 5, at 9%; (b) April 1, at 7%; or (c) April 5, at 8%.


$72.15 LYNCHBURG, VA. Mar. 16 192

Ninety days after date I promise to pay to the order of E. R. Duncan

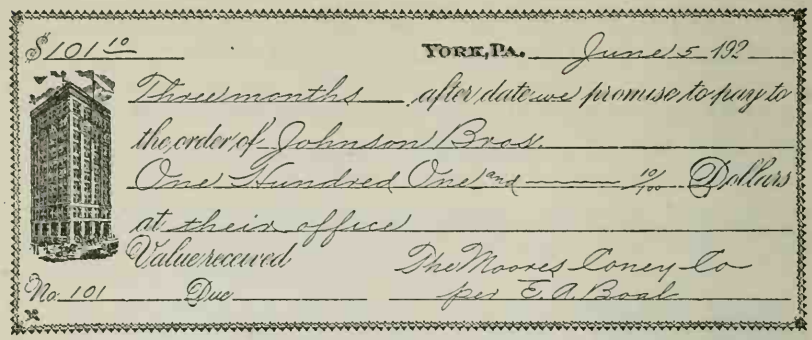
Seventy-two 15/100 Dollars

at Fifth-Third National Bank

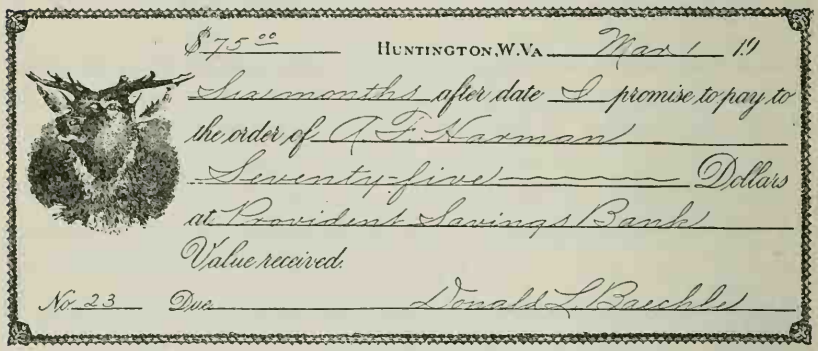
Value received

No. 21 Due Harrison A. Moore

4. You are to ascertain the amount of cash received by Mr. Duncan if this note was discounted at the bank on (a) April 1, at 6%; (b) May 1, at 8%; or (c) May 31, at 9%.



5. You are to ascertain the amount of cash Johnson Bros. received if this note was discounted at the bank on (a) July 3, less 7% discount; (b) July 25, less 8% discount; or (c) July 30, less 9% discount.



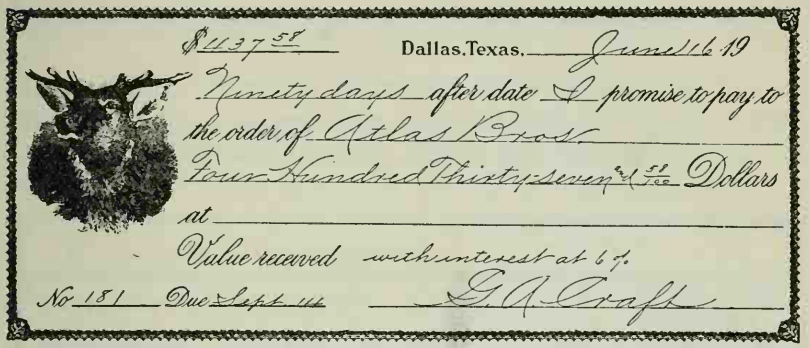
6. You are to ascertain the amount of cash that would be received from the bank by Mr. Harman if this note was discounted on (a) March 10, at 6%; (b) April 1, at 8%; or (c) May 1, at 7%.

EXERCISE No. 182, DISCOUNTING INTEREST-BEARING NOTES

When an interest-bearing note is discounted, it is necessary to ascertain the maturity value by adding to the face of the note,

the interest for the number of days between the date and maturity of the note at the designated rate. It is necessary to know the maturity value, because the present value is always calculated on the maturity value.

Atlas Bros. received from G. A. Craft the note illustrated below and discounted it at 8% at the Merchants National Bank on July 2. The calculations necessary to ascertain (a) the maturity value, and (b) the present value are shown below.


$437.58 Dallas, Texas, June 16 19

Ninety days after date I promise to pay to the order of Atlas Bros.

Four Hundred Thirty-seven 58/100 Dollars

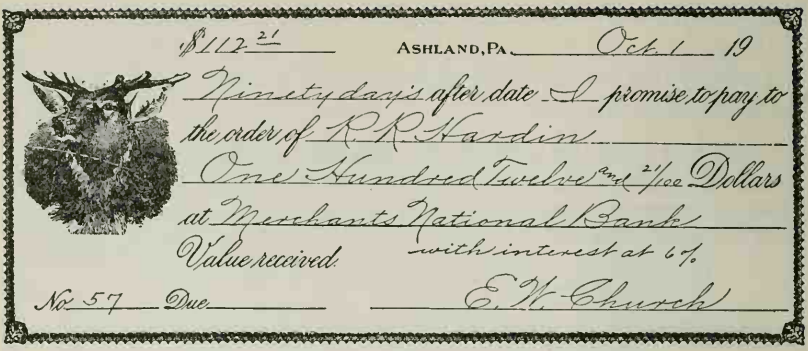
at

Value received with interest at 6%.

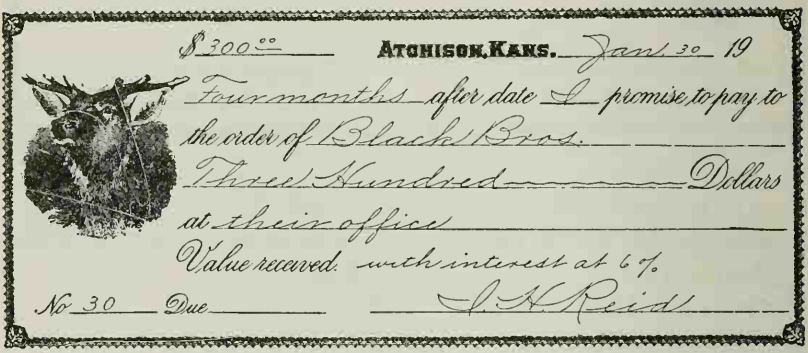
No. 151 Due Sept. 14 G. A. Craft

Face of the note, $437.58
Interest at 6% for 90 days = $6.56
Maturity value = $437.58 + $6.56 = $444.14
Date of note, June 16
Due date (14 + 31 + 31 + 14) September 14
July 2 to September 14 = (29 + 31 + 14) 74 days
Interest on $444.14 for 74 days at 6% (.44414 × $12\frac{1}{3}$) = 5.47772
8% = $1\frac{1}{3}$ times 6%
$5.47772 × $1\frac{1}{3}$ = $7.30 the discount
$444.14 − $7.30 = $436.84 = cash received by Atlas Bros.

The first information necessary is the maturity value of the note, which is the face of the note plus 6% interest for 90 days. The number of days the bank will have to wait before maturity is the difference in time between July 2 and September 14, or 90 days minus the time between the date of the note and the date discounted. The present value of the note is the difference between the maturity value of the note and the interest on the maturity value at 8% for the number of days Atlas Bros. will use the money before the bank makes collection.

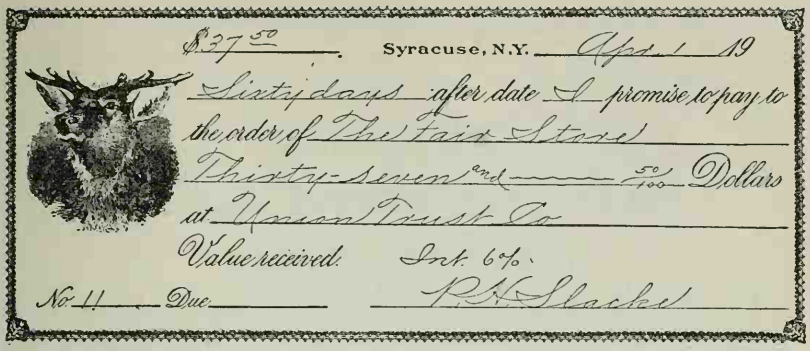


1. You are to ascertain the amount of cash Mr. Hardin would receive from the bank if this note was discounted (a) October 15, at 8%; (b) November 1, at 7%; or (c) December 11, at 9%.



2. You are to ascertain the amount of cash received from the bank by Black Bros. if this note was discounted at the bank on (a) February 5, at 7%; (b) March 1, at 8%; or (c) April 1, at 6%.

The due date is 4 months from January 30 or May 30, but this being a legal holiday it cannot be collected until May 31. The number of days between January 30 and May 31 counting 28 days in February is 121 days. The maturity value of this note will be the face plus interest at 6% for 121 days. Some banks would add to the face of this note the interest for four months or 120 days disregarding the actual number of days. However, the tendency in modern banking is to use the actual number of days in interest calculations and unless otherwise instructed you will follow this plan when the time of an interest-bearing-note is a designated number of months.


$37.50 Syracuse, N.Y. Apr. 1 19

Sixty days after date I promise to pay to the order of The Fair Store

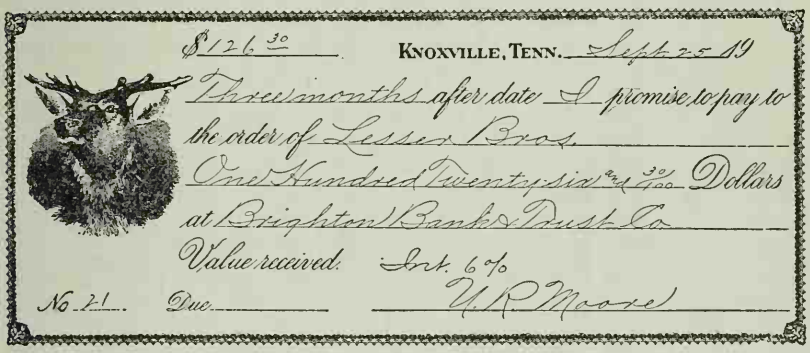
Thirty-seven and 50/100 Dollars

at Union Trust Co

Value received. Int. 6%.

No. 11 Due. R. H. Slacker

3. You are to ascertain the amount of cash The Fair Store would receive from the bank if this note was discounted (a) April 20, at 8%; (b) May 1, at 7%; or (c) May 15, at 6%.


$126.30 KNOXVILLE, TENN. Sept. 25 19

Three months after date I promise to pay to the order of Lesser Bros.

One Hundred Twenty-six and 30/100 Dollars

at Brighton Bank & Trust Co

Value received. Int. 6%

No. 21 Due. U. R. Moore

4. You are to ascertain the amount of cash received by Lesser Bros. if this note was discounted (a) October 1, at 7%; (b) November 1, at 8%; or (c) November 15, at 8%.

CHAPTER XXI

BANKING AND INTEREST (Concluded)

TIME AND INTEREST TABLES

For the convenience of the discount clerks in banks it is customary to have available tables which will facilitate the calculations involved in ascertaining the interest on loans made by the bank or notes purchased by the bank. Below is given a table which contains information that will facilitate finding the exact number of days between two given dates.

From Any Day of	To the Same Day of the Next											
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
January	365	31	59	90	120	151	181	212	243	273	304	334
February	334	365	28	59	89	120	150	181	212	242	273	303
March	306	337	365	31	61	92	122	153	184	214	245	275
April	275	306	334	365	30	61	91	122	153	183	214	244
May	245	276	304	335	365	31	61	92	123	153	184	214
June	214	245	273	304	334	365	30	61	92	122	153	183
July	184	215	243	274	304	335	365	31	62	92	123	153
August	153	184	212	243	273	304	334	365	31	61	92	122
September	122	153	181	212	242	273	303	334	365	30	61	91
October	92	123	151	182	212	243	273	304	335	365	31	61
November	61	92	120	151	181	212	242	273	304	334	365	30
December	31	62	90	121	151	182	212	243	274	304	335	365

To find the exact number of days from any day of any month to the corresponding day of any other month, within a year, find the column of the last month directly opposite the line of the first month. From March 3 to June 3 is 92 days; from October 4 to December 4 is 61 days; from February 3 to November 16 is 273+13 or 286 days. In leap years, add one day if February 29 is between the two dates given.

The table below gives the interest on $100 for the time stated at the left, and at the rate stated at the top; the interest calculations are based on a year of 360 days. Thus, the interest on $100 for 1 day at 4% is .0111 as stated on the first line, fourth column, from the left in the table; the interest on $100 for 29 days at 6½% is .5236 as stated in the second column from the right on a line with 29 days at the left.

SIMPLE INTEREST TABLE

($100.00 on a 360-Day Year Basis)

Time	2½%	3%	3½%	4%	4½%	5%	5½%	6%	6½%	7%
1 da.	.0069	.0083	.0097	.0111	.0125	.0139	.0153	.0167	.0181	.0194
2 da.	.0139	.0167	.0194	.0222	.0250	.0278	.0306	.0333	.0361	.0389
3 da.	.0208	.0250	.0292	.0333	.0375	.0417	.0458	.0500	.0542	.0583
4 da.	.0278	.0333	.0389	.0444	.0500	.0556	.0611	.0667	.0722	.0778
5 da.	.0347	.0417	.0486	.0556	.0625	.0694	.0764	.0833	.0903	.0972
6 da.	.0417	.0500	.0583	.0667	.0750	.0833	.0917	.1000	.1083	.1167
7 da.	.0486	.0583	.0681	.0778	.0875	.0972	.1069	.1167	.1264	.1361
8 da.	.0556	.0667	.0778	.0889	.1000	.1111	.1222	.1333	.1444	.1556
9 da.	.0625	.0750	.0875	.1000	.1125	.1250	.1375	.1500	.1625	.1750
10 da.	.0694	.0833	.0972	.1111	.1250	.1389	.1528	.1667	.1806	.1944
11 da.	.0764	.0917	.1069	.1222	.1375	.1528	.1681	.1833	.1986	.2139
12 da.	.0833	.1000	.1167	.1333	.1500	.1667	.1833	.2000	.2167	.2333
13 da.	.0903	.1083	.1264	.1444	.1625	.1806	.1986	.2167	.2347	.2528
14 da.	.0972	.1167	.1361	.1556	.1750	.1944	.2139	.2333	.2528	.2722
15 da.	.1042	.1250	.1458	.1667	.1875	.2083	.2292	.2500	.2708	.2917
16 da.	.1111	.1333	.1556	.1778	.2000	.2222	.2444	.2667	.2889	.3111
17 da.	.1181	.1417	.1653	.1889	.2125	.2361	.2597	.2833	.3069	.3306
18 da.	.1250	.1500	.1750	.2000	.2250	.2500	.2750	.3000	.3250	.3500
19 da.	.1319	.1583	.1847	.2111	.2375	.2639	.2903	.3167	.3431	.3694
20 da.	.1389	.1667	.1944	.2222	.2500	.2778	.3056	.3333	.3611	.3889
21 da.	.1458	.1750	.2042	.2333	.2625	.2917	.3208	.3500	.3792	.4083
22 da.	.1528	.1833	.2139	.2444	.2750	.3056	.3361	.3667	.3972	.4278
23 da.	.1597	.1917	.2236	.2556	.2875	.3194	.3514	.3833	.4153	.4472
24 da.	.1667	.2000	.2333	.2667	.3000	.3333	.3667	.4000	.4333	.4667
25 da.	.1736	.2083	.2431	.2778	.3125	.3472	.3819	.4167	.4514	.4861
26 da.	.1806	.2167	.2528	.2889	.3250	.3611	.3972	.4333	.4694	.5056
27 da.	.1875	.2250	.2625	.3000	.3375	.3750	.4125	.4500	.4875	.5250
28 da.	.1944	.2333	.2722	.3111	.3500	.3889	.4278	.4667	.5056	.5444
29 da.	.2014	.2417	.2819	.3222	.3625	.4028	.4431	.4833	.5236	.5639
1 mo.	.2083	.2500	.2917	.3333	.3750	.4167	.4583	.5000	.5417	.5833
2 mo.	.4167	.5000	.5833	.6667	.7500	.8333	.9167	1.0000	1.0833	1.1667
3 mo.	.6230	.7500	.8750	1.0000	1.1250	1.2500	1.3750	1.5000	1.6250	1.7500
4 mo.	.8333	1.0000	1.1667	1.3333	1.5000	1.6667	1.8333	2.0000	2.1667	2.3333
5 mo.	1.0417	1.2500	1.4583	1.6667	1.8750	2.0833	2.2917	2.5000	2.7083	2.9160
6 mo.	1.2500	1.5000	1.7500	2.0000	2.2500	2.5000	2.7500	3.0000	3.2500	3.5070

EXERCISE No. 183, USE OF INTEREST TABLES

When the desired interest is ascertained through the use of time and interest tables, it is necessary first to ascertain the time from the time table and the interest on $100 for this time from the interest table. The given principal multiplied by the interest on $100 for the given time will produce the desired interest provided two places are pointed off in the product because of the $100 basis. The illustration below shows the method of using the time and interest tables when it is desired to ascertain the interest on $725.40 from June 9 to August 10 at 6%.

June 9 to August 10 is 62 days. Referring to the interest table you will observe that the interest on $100 at 6% for 60 days is $1.00 and for 2 days it is .0333. $1.00 + .0333 = 1.0333 interest at 6% for sixty-two days on $100. The interest on $725.40 = 7.2540 × $1.0333 = 7.4955582 = $7.50.

The following problems provide written practice in applying the time and interest tables to the solution of problems requiring the interest on a given principal at a stated rate for a specified time.

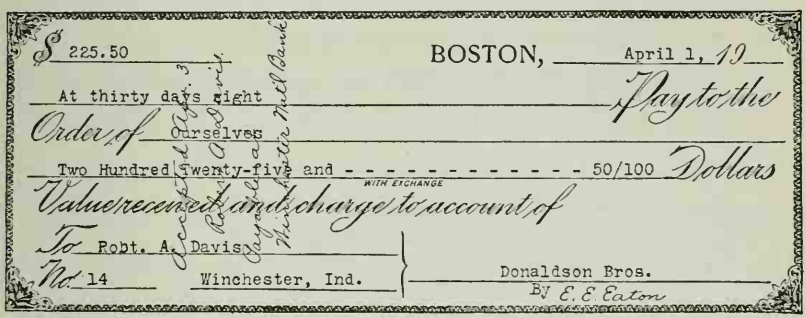
1. $ 840.25 from May 11 to June 19 at 7%
2. 17.50 from May 5 to May 27 at 5%
3. 4,500.00 from July 6 to October 11 at 4½%
4. 6,000.00 from September 6 to December 24 at 3%
5. 375.12 from March 17 to March 29 at 7%
6. 335.85 from May 1 to October 1 at 4½%
7. 250.00 from May 4 to October 7 at 6%
8. 725.75 from July 1 to October 1 at 6%
9. 960.50 from May 19 to September 11 at 6½%
10. 425.24 from June 16 to October 12 at 4½%

DRAFTS

A *draft* is a written order by the creditor to his debtor asking the debtor to pay the amount of the indebtedness to a third party. Drafts are generally used in business for collecting from debtors where it is not convenient to collect in person. If the creditor wishes the debtor to have more time to pay the account, he states

the number of days in the draft. If he wishes the account paid at once, he makes the draft payable at sight. A draft drawn a designated number of days after date must be accepted by the debtor before it becomes effective.

The one drawing the draft is known as the *drawer*, the one on whom it is drawn is the *drawee*, and the one in whose favor it is drawn is the *payee*. All drafts may be interpreted as meaning that the drawee owes the drawer, and the drawer has asked the drawee to pay the amount to the payee.



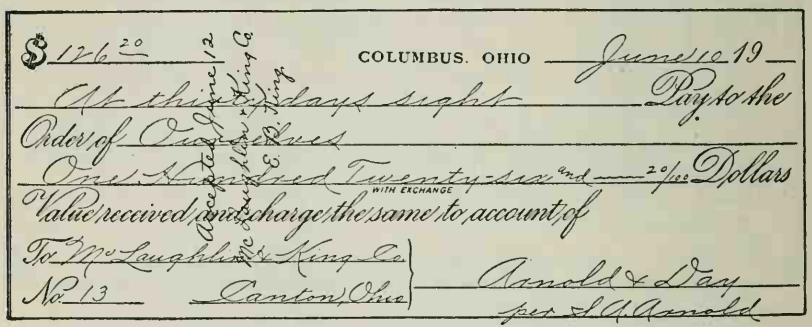
Robert A. Davis of Winchester, Indiana, owes Donaldson Bros. of Boston, Massachusetts, $225.50. Donaldson Bros. cannot conveniently present the account in person for collection, hence have written Mr. Davis asking for the privilege of drawing the draft payable 30 days after sight for the amount. Mr. Davis grants the request and the draft is drawn payable to Donaldson Bros. and is sent to the Winchester National Bank for collection. When the bank received the draft, it was presented to Mr. Davis and accepted by him. The indebtedness is now in the form of a written contract and Donaldson Bros. can borrow its present value from the bank using the accepted draft as security. If Donaldson Bros. do not wish to discount the draft, they can instruct the bank to retain it until maturity, collect the draft and remit to them the amount collected less the charges for collection. The foregoing illustrates one of the principal purposes for which drafts are drawn.

EXERCISE No. 184, DISCOUNTING DRAFTS

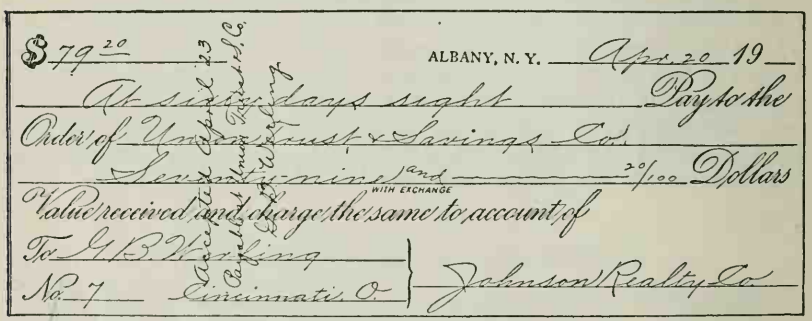
When a bank discounts an accepted draft, it pays the maturity value less the agreed discount from the day the draft is discounted until maturity. Drafts are usually made payable a designated number of days after sight, hence the maturity is the stated number of days after the date of acceptance. However drafts are

sometimes made payable a designated number of days after date, in which case the maturity is the designated number of days after the date of the draft and not the date of acceptance. Sight drafts, except when used for foreign shipments, are seldom bought by banks, because they are payable upon presentation, hence, no written contract is involved.

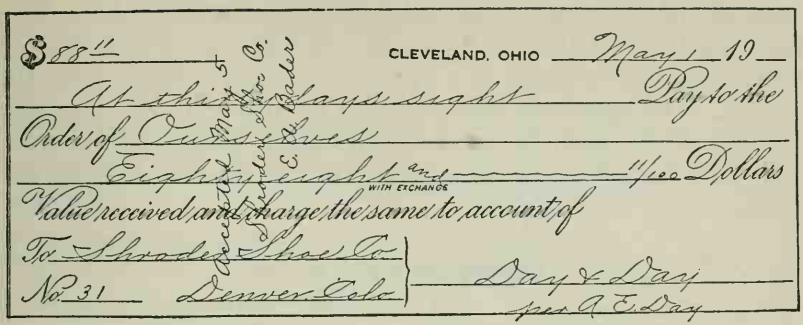
The following accepted drafts and the instructions pertaining to each provide written practice in ascertaining (a) the discount on an accepted draft, and (b) the cash value on the day it is discounted.


$ 126 20 COLUMBUS, OHIO June 10 19
At thirty days sight Pay to the
Order of Ourselves
One Hundred Twenty-six and 20/100 Dollars
WITH EXCHANGE
Value received and charge the same to account of
To McLaughlin & King Co.
No. 13 Canton, Ohio
Arnold & Day
per S. A. Arnold
Accepted June 12
McLaughlin & King Co.
E. B. King

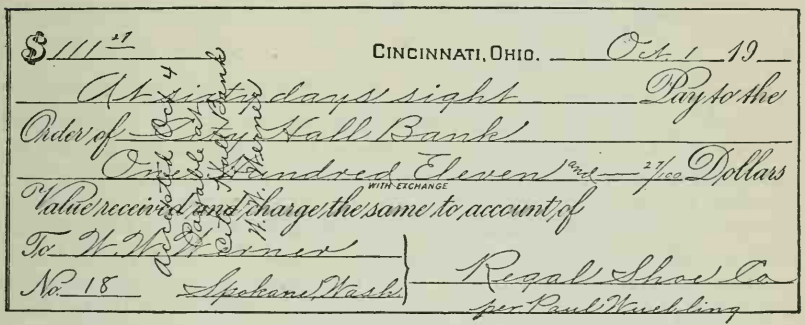
1. You are to ascertain the amount of cash Arnold & Day would receive, if this draft was discounted at the bank (a) June 12 at 7%, (b) June 25 at 8%, or (c) July 5 at 8%.


$ 79 20 ALBANY, N. Y. Apr. 20 19
At sixty days sight Pay to the
Order of Union Trust & Savings Co.
Seventy-nine and 20/100 Dollars
WITH EXCHANGE
Value received and charge the same to account of
To G. B. Werling
No. 7 Cincinnati, O.
Johnson Realty Co.
Accepted April 23
Royal Bank Union Trust & S. Co.
G. B. Werling

2. You are to ascertain the amount Johnson Realty Co. would receive if this draft was discounted at the bank (a) May 6 at $4\frac{1}{2}$%, (b) May 20 at 5%, or (c) June 1 at 6%.


$88 11 CLEVELAND, OHIO May 1 19
At thirty days sight Pay to the
Order of Ourselves
Eighty eight and 11/100 Dollars
WITH EXCHANGE
Value received and charge the same to account of
To Shroder Shoe Co.
No. 31 Denver, Colo.
Day & Day
per A. E. Day
Accepted May 5
Shroder Shoe Co.
E. A. Bader

3. You are to ascertain the amount of cash Day & Day would receive from the bank if this draft was discounted (a) May 8 at 8%, (b) May 10 at 7½%, or (c) May 15 at 9%.


$111 27 CINCINNATI, OHIO. Oct. 1 19
At sixty days sight Pay to the
Order of City Hall Bank
One Hundred Eleven and 27/100 Dollars
WITH EXCHANGE
Value received and charge the same to account of
To W. W. Werner
No. 18 Spokane, Wash.
Regal Shoe Co.
per Paul Wuebling
Accepted Oct 4
Payable at
City Hall Bank
W. W. Werner

4. You are to ascertain the amount of cash the Regal Shoe Co. would receive from the bank if this draft was discounted (a) October 22 at 6%, (b) October 30 at 7%, or (c) November 15 at 8%.

TRADE ACCEPTANCE

A *trade acceptance* is a time draft drawn in settlement of a sale of merchandise. The difference between a trade acceptance and a time draft is that the former is drawn at the time a debt is contracted, while the latter is drawn for the purpose of collecting a past due account. Trade acceptances are given preference by the Federal Reserve Banks, hence are always drawn for the

purpose of securing in negotiable form a written evidence of a sale at the time the sale is made. The merchant who extends credit on open account can collect only in accordance with the terms. The merchant who sells and secures a trade acceptance cannot collect until the trade acceptance is due, but he can sell the trade acceptance to a bank and secure the cash less the discount.

TRADE ACCEPTANCE

No. 312 EASTON, PA. July 20 19

To Seaton Bros. Clayton, Mo.

On August 25 (DATE OF MATURITY) Pay to the order of Ourselves

Two Hundred Seventy-five 87/100 Dollars, ($ 275.87)

The obligation of the acceptor hereof arises out of the purchase of goods from the drawer. The drawee may accept this bill payable at any bank, banker or trust company in the United States which he may designate.

Accepted at Clayton, Mo. on July 25 191

Payable at First National Bank

Seaton Bros. (SIGNATURE OF ACCEPTOR)

By E. A. Seaton

R. A. Watson & Co.

By P. M. Davis

July 20, R. A. Watson & Co. sold Seaton Bros. merchandise for $275.87. Seaton Bros. agreed to honor a trade acceptance. The invoice for the merchandise was mailed to Seaton Bros. and the trade acceptance sent either to them or to the First National Bank for acceptance. Usually a trade acceptance is sent to the debtor and he accepts it and returns it either to the creditor or to the bank. If this trade acceptance was sold to the bank, the deduction for discount would be the interest on the amount for the number of days from the date the bank purchased it up to August 25.

EXERCISE No. 185, DISCOUNTING TRADE ACCEPTANCES

An accepted trade acceptance is a written negotiable contract the same as an accepted draft or a signed note. It is given preference by the banks because it is given preference by the Federal Reserve Banks. This means that a bank holding a trade acceptance can rediscount it with a Federal Reserve Bank in case it needs the money, and that the Federal Reserve Bank will buy trade acceptances in preference to drafts or notes. The following trade acceptances and instructions pertaining to each provide written practice in ascertaining, (a) the discount on a trade acceptance, and (b) the cash value on the day it is discounted.

TRADE ACCEPTANCE

No. 18 CHANUTE, KANSAS, Oct. 1, 19

To Kloak Bros. Co. Cincinnati, Ohio

On November 15 (DATE OF MATURITY) Pay to the order of Ourselves

One Hundred One and 50/100 Dollars, ($101.50)

The obligation of the acceptor hereof arises out of the purchase of goods from the drawer. The drawee may accept this bill payable at any bank, banker or trust company in the United States which he may designate.

Accepted at Cincinnati on Oct. 3 191

Payable at Fifth Third National Bank

Kloak Bros. Co.

By (SIGNATURE OF ACCEPTOR) S. M. Stickley

By Towns Grocery Co.

By C. E. Gundlach

1. You are to ascertain the amount of cash the Towns Grocery Co. would receive from the bank if this trade acceptance was discounted (a) October 5 at 6%, (b) October 20 at 7%, or (c) November 5 at 8%.

NOTE: When the due date is stated specifically in a trade acceptance, the date, and the date of acceptance do not affect the interest calculations.

TRADE ACCEPTANCE

No. 2 Houston, Texas, Mar. 2 19

To The Silverstone Supply Co Norwood, Ohio

On May 1 (DATE OF MATURITY) Pay to the order of Ourselves

Two Hundred Seventy-two and 42/100 Dollars, ($272.42)

The obligation of the acceptor hereof arises out of the purchase of goods from the drawer. The drawee may accept this bill payable at any bank, banker or trust company in the United States which he may designate.

Accepted at Norwood on Mar. 5 191

Payable at Norwood National Bank

The Silverton Supply Co.

By (SIGNATURE OF ACCEPTOR) L. M. Stallman

By McKenzie Mfg. Co.

By C. E. Ernst

2. You are to ascertain the amount of cash the McKinzie Manufacturing Company would receive for this trade acceptance if sold to the bank on (a) March 9 at 5%, (b) April 1 at 6%, or (c) May 1 at 8%.

TRADE ACCEPTANCE

No. 8 PORTSMOUTH, VA. Nov. 10 19

To The F. H. Lawson Co. Minneapolis, Minn.

On Jan. 15 (DATE OF MATURITY) Pay to the order of myself

One Hundred Thirty-eight and 90/100 Dollars, ($138.90)

The obligation of the acceptor hereof arises out of the purchase of goods from the drawer. The drawee may accept this bill payable at any bank, banker or trust company in the United States which he may designate.

Accepted at Minneapolis on Nov. 22 191

Payable at Union National Bank

The F. H. Lawson Co. (SIGNATURE OF ACCEPTOR)

By D. A. Anstead

By M. R. Griffith

By

3. You are to ascertain the amount of money Mr. Griffith would receive for this trade acceptance if discounted (a) December 5 at 7%, (b) December 24 at 7%, or (c) January 2 at 9%.

TRADE ACCEPTANCE

No. 4 SEATTLE, WASHINGTON, July 1 19

To The J. R. Stevens Co. Frankfort, Ky.

On October 1 (DATE OF MATURITY) Pay to the order of Ourselves

Two Thousand Seven Hundred Fifty Dollars, ($2750.00)

The obligation of the acceptor hereof arises out of the purchase of goods from the drawer. The drawee may accept this bill payable at any bank, banker or trust company in the United States which he may designate.

Accepted at Frankfort on July 3 191

Payable at Merchants National Bank

The J. R. Stevens Co. (SIGNATURE OF ACCEPTOR)

By J. R. Stevens

By The Ferris Construction Co.

By G. E. Bruchle

4. You are to ascertain the amount of cash The Ferris Construction Company would receive for this trade acceptance if discounted (a) July 15 at 6%, (b) August 1 at 6%, or (c) September 1 at 6%.

EXERCISE No. 186, DISCOUNTING COMMERCIAL PAPERS

Notes, accepted drafts, and accepted trade acceptances are usually referred to as *commercial papers*. The Garner Wholesale Grocery Company discounted the commercial papers given in the following list at the City National Bank on August 20, at 8% discount. You are to show on tablet paper (a) all the calculations necessary to obtain the desired information regarding each note

as indicated by the columns which are blank, and (b) the total amount of credit the Garner Wholesale Grocery Company received for these discounted papers.

No.	Date of Paper	Time	Rate	Date Due	Face of Paper	Interest	Discount	Proceeds
1.	June 5	3 mo.	6%		$ 2,000.00			
2.	June 1	4 mo.	6%		2,500.00			
3.	Aug. 1	90 da.	no		2,000.00			
4.	June 5	90 da.	6%		425.55			
5.	July 12	60 da.	no		827.50			
6.	May 16	5 mo.	6%		1,841.44			
7.	Aug. 1	60 da.	no		4,000.00			
8.	Mar. 5	6 mo.	no		627.84			
9.	July 10	90 da.	6%		721.84			
10.	June 5	90 da.	6%		316.65			
11.	July 12	90 da.	6%		2,215.40			
12.	Aug. 1	60 da.	no		10,000.00			
13.	July 6	60 da.	8%		1,421.60			
14.	July 12	90 da.	6%		2,715.27			
15.	July 16	4 mo.	6%		897.46			
16.	July 17	60 da.	7%		1,500.00			
17.	Aug. 1	60 da.	no		3,000.00			
18.	Aug. 1	60 da.	6%		2,000.00			
19.	May 11	5 mo.	6%		432.51			
20.	July 16	60 da.	no		98.50			

EXERCISE No. 187, AUDITING INTEREST CALCULATIONS

The Loans Register is a book used by banks for recording detailed information regarding the commercial papers held by it as evidence of loans. The nine columns on page 274 contain the facts regarding the loans made by the City National Bank on June 5 as recorded in the Loans Register. The borrower receives the face of the note on interest-bearing notes dated June 5, and the face of the note less 6% interest on non-interest-bearing notes dated on this date. The discount rate on notes dated before June 5 is 6%. This means that the borrower receives the present value, which is maturity value less 6% interest for the number of days between June 5 and maturity. You are (a) to show on tablet paper all the calculations necessary to verify the facts recorded, and (b) to find the sum of the correct proceeds of all the notes.

No.	Date of Paper	Time	Rate	Date Due	Face of Paper	Interest	Discount	Proceeds
1.	6/5	3 mo.	6	9/5	$ 200			$ 200.00
2.	5/26	60 da.	6	7/25	500	$ 5	$ 4.11	500.79
3.	5/6	90 da.	6	8/4	1,000	14	10.15	1,002.75
4.	6/5	60 da.	No	8/4	400		4.00	395.00
5.	4/1	90 da.	6	6/30	600	10	2.64	606.46
6.	5/1	4 mo.	6	9/1	350	8	5.24	351.76
7.	6/5	90 da.	6	9/3	5,500			5,500.00
8.	6/5	90 da.	No	9/3	7,500		112.50	7,387.50
9.	4/15	120 da.	6	8/13	2,000	40	24.46	2,016.54
10.	6/4	60 da.	No	8/3	960		9.54	950.56
11.	5/15	90 da.	6	8/13	5,000	75	58.46	5,016.64
12.	5/1	60 da.	6	6/30	4,000	40	17.83	4,022.17
13.	6/5	90 da.	6	8/3	3,000			3,000.00
14.	5/31	60 da.	6	7/30	2,500	25	24.15	2,501.85
15.	6/5	60 da.	No	8/4	6,000		60.00	5,930.00

EXERCISE No. 188, CERTIFICATES OF DEPOSIT

Banks sometimes pay interest for the use of money belonging to others. The usual conditions under which interest is paid are: (a) on certificates of deposit, (b) on daily balances of large checking accounts, (c) on savings accounts, (d) through rediscounting notes, and (e) on money deposited with them by their correspondent banks.

When money is desposited with a bank for a definite time and not subject to check, the bank acknowledges receipt of the money by issuing a form known as a *Certificate of Deposit* which states the time, amount, and rate of interest. Depositors who maintain a checking account with a large balance are allowed a small rate of interest, usually 2%, on the daily balances. When a bank discounts a note, its profit is either the interest collected in advance or collected at maturity; should the bank discount this note with another bank and secure the cash before maturity, it will lose a part of the interest.

A correspondent bank is one with which a bank does a regular interchange business. For instance, the Commercial Bank in Indianapolis may send items for collection to the First National

Bank in Chicago and have the proceeds credited to its account with the Chicago bank. The Indianapolis bank can draw drafts on this balance which are termed Chicago exchanges. The Chicago bank is a correspondent bank of the Indianapolis bank, and the Indianapolis bank is a correspondent bank of the Chicago bank.

A Certificate of Deposit is a written promise of the bank to pay money to the holder because the holder deposited money with the bank. Some banks require money to be left with them 4 months, others 6 months, and others a year before interest will be paid. The rate of interest is determined by the demand for money but is usually 3% or 4%. A Certificate of Deposit affords an excellent means of securing an income from money which the owner does not wish to invest permanently.

CERTIFICATE OF DEPOSIT

FARMERS STATE BANK 76-1112 10

ERICSON, NEBR. Mar 1 19 No 9560

THIS CERTIFIES THAT J. M. Reilly HAS DEPOSITED IN THIS BANK

One Thousand and no/100 $1000.00

PAYABLE TO THE ORDER OF J. R. Baker

ON THE RETURN OF THIS CERTIFICATE PROPERLY ENDORSED 6 MONTHS AFTER DATE

WITH INTEREST AT THE RATE OF 4 PER CENT PER ANNUM

NO INTEREST AFTER MATURITY.

James R. Epley CASHIER

NOT SUBJECT TO CHECK

The following problems provide written practice in ascertaining the interest on a Certificate of Deposit. These represent money left with the bank for a definite time and on which the bank is to pay the stated interest. You may assume that the bank allows interest for only 30 days after the maturity of any certificate not paid at maturity. You are to show on tablet paper all of the calculations necessary to ascertain the amount paid by the bank for each certificate.

No.	Date	Amount	Time	Rate	Date Paid	Amount Paid
1.	May 6	$ 5,000.00	6 mos.	3½%	Nov. 6	
2.	July 7	1,000.00	4 mos.	4%	Nov. 7	
3.	Feb. 6	12,500.00	1 year	4%	Feb. 6	
4.	May 12	250.00	3 mos.	4½%	Aug. 12	
5.	Oct. 11	9,500.00	6 mos.	2½%	May 31	
6.	June 16	11,856.00	1 year	2½%	June 16	

No.	Date	Amount	Time	Rate	Date Paid	Amount Paid
7.	Jan. 2	9,000.00	4 mos.	3½%	June 10	
8.	July 2	9,000.00	6 mos.	4%	Feb. 6	
9.	Oct. 27	25,000.00	90 days	3%	Mar. 9	
10.	Sept. 6	6,250.00	4 mos.	3%	Feb. 5	
11.	Dec. 4	1,560.00	5 mos.	4%	May 4	
12.	Mar. 5	2,500.00	6 mos.	4%	Oct. 25	
13.	April 12	18,565.00	1 year	2½%	April 12	
14.	June 6	7,500.00	90 days	4½%	Oct. 16	
15.	Oct. 9	450.00	4 mos.	4%	Mar. 30	
16.	Nov. 6	28,500.00	3 mos.	3½%	Feb. 6	
17.	Feb. 6	6,650.00	6 mos.	3½%	Sept. 10	
18.	Oct. 11	9,850.00	90 days	2½%	Feb. 20	
19.	Dec. 1	3,000.00	90 days	4½%	April 10	
20.	May 11	6,500.00	6 mos.	3%	Dec. 31	

EXERCISE No. 189, INTEREST ON DAILY BANK BALANCES

Some banks allow interest on checking accounts. There is no specific rule governing the method of ascertaining the interest, the calculations being based on the custom established by the bank which allows the interest. The illustration below shows one method of ascertaining interest on daily balances.

This illustration is applicable to the daily balances for a customer of The First National Bank of San Francisco, California, during the month of September, interest rate, 2%. The daily balances, given in the same order as the days of the month beginning with the first and including the thirtieth are as follows:

$7.60	6.10	8.20	7.20	6.80	10.80
7.60	6.10	9.20	7.00	7.40	11.40
7.60	6.30	9.70	7.00	7.40	12.20
7.60	6.30	10.20	6.80	8.90	12.70
7.10	6.50	10.20	7.10	8.70	13.10

Total for 30 days = 250.80

The figures express thousands and hundreds. Thus, the first balance "7.60" was $7,613.68. All figures except those in the thousands and the beginning one in the hundreds column are omitted to facilitate the interest calculations. The sum of the balances for each of the 30 days in September is 250,800. In other words, this customer had what was equivalent to $250,800 on deposit in the bank for one day. The interest on this amount at 2% for the year would be $5,016. However, since the amount is for only one day, it is necessary to divide it by either 360 or 365 depending on the basis used. If the amount is divided by 365, the interest would be $13.74; if divided by 360, the interest would be $13.93.

The following problems provide written practice in ascertaining the interest due a customer on his daily balances. Add without copying and show the calculations necessary to ascertain the interest. Show the interest on a basis of (a) 365 days, and (b) 360 days in each problem.

1.	2.	3.	4.	5.	6.
Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
2%	2½%	2%	2½%	2%	2½%
13.90	33.40	48.30	73.90	110.10	98.10
13.90	33.90	48.50	83.20	110.20	97.30
14.00	34.50	49.20	85.20	110.30	95.40
15.20	34.10	49.20	89.60	112.60	93.20
14.70	34.80	48.80	97.50	115.70	89.60
14.40	34.80	49.10	108.20	118.30	87.50
14.80	37.80	51.50	109.50	114.10	84.30
15.00	38.20	56.10	100.20	112.50	85.90
15.00	38.30	56.10	116.40	112.60	87.50
15.40	38.80	56.30	113.50	99.80	82.60
16.00	39.20	56.30	98.40	98.60	78.90
16.20	39.20	57.30	95.40	96.70	78.70
16.80	39.20	57.80	90.40	96.80	76.40
18.70	39.30	59.30	99.30	95.40	75.30
19.00	40.20	59.60	98.60	93.30	74.60
19.00	40.20	59.60	97.50	94.50	74.90
19.00	40.60	59.10	98.30	99.80	78.90
21.30	41.20	59.10	94.70	98.70	82.40
22.50	41.40	60.20	94.80	96.40	85.90
23.00	41.40	60.40	93.60	97.80	87.80
23.20	44.10	60.60	96.40	98.10	86.30
24.20	44.40	60.50	96.50	97.20	87.10
24.20	44.40	61.60	96.60	99.90	80.20
26.70	44.70	61.70	99.90	95.30	82.50
27.20	46.50	61.70	104.10	96.40	83.60
27.80	47.10	62.20	104.10	97.80	82.20
28.10	47.10	62.40	104.20	96.50	84.40
29.00	47.80	62.40	104.30	99.30	89.10
29.30	47.90	62.80	103.60		88.70
29.30	48.30	62.80	105.10		86.40
32.50		61.80	106.90		81.30

EXERCISE No. 190, INTEREST ON DEPOSITS BY BANKS

When one bank deposits funds with another and interest is paid on the deposit, the rate of interest and the terms on which it is paid are fixed by agreement. The method of calculating the interest will be the same as on notes discounted, that is, the amount of interest due the bank that lends the money will be the interest on the principal at the given rate for the number of days the money has remained on deposit. This is equivalent to saying that the bank receiving the deposit would pay interest at the agreed rate for the number of days it has the money.

The following problems provide written practice in calculating the amount of interest that would be paid to a depositing bank for interest on deposits as per agreement. You are to show on tablet paper all the calculations necessary to find the amount due the depositing bank in accordance with the terms stated in each problem.

1. The First National Bank in Plymouth, Indiana, had an agreement with The Chicago City Bank and Trust Company of Chicago to receive interest at 2% on amounts deposited with The Chicago City Bank and Trust Company, from the date of the deposits to the time the amounts were withdrawn. Below is an account showing a record of the transactions on the books of The Chicago City Bank and Trust Company during a certain year.

FIRST NATIONAL BANK, PLYMOUTH, INDIANA

Mar.	1			2000		Jan.	7			2000	
April	17			2255	50	Feb.	29			5000	
July	16			15000		Mar.	17			4000	
Nov.	5			9527	48	May	16			16641	74
						July	6			17500	
						Sept.	11			22565	85
						Oct.	6			16665	40
						Dec.	1			10000	
						Dec.	12			12500	

You are to ascertain the amount of interest that was credited to the First National Bank of Plymouth on December 31. Calculate the interest at 2% on the amounts on each side of the account up to and including December 31 and find the difference between the two sums.

2. On May 17, the Central National Bank of Cleveland, Ohio, received from the National City Bank of Akron, Ohio, \$18,565.75, interest at $2\frac{1}{2}\%$ to be allowed on this if it remained in the bank more than three months. The amount was withdrawn, October 26. What amount is due the National City Bank of Akron on that date?

3. July 7, the Concord National Bank of Concord, Massachusetts, deposited with the First National Bank of Boston, \$47,500 with the understanding that it was to receive $1\frac{1}{2}\%$ interest from date until withdrawn. \$10,000 was withdrawn October 6, and the balance February 4, of the following year. What amount of interest is due the Concord National Bank on February 4?

Calculate the interest on the full amount up to the date of the first withdrawal and on the balance after the withdrawal from the date of the withdrawal up to February 4.

4. March 10, the Merchants & Farmers Bank of Marietta, Georgia, deposited with the Atlanta Commercial Bank of Atlanta, Georgia, \$37,500, with the understanding that it was to receive 2% interest on the amount during the time it was with the Atlanta Commercial Bank. The amount was withdrawn, July 27. How much was due the Merchants & Farmers Bank of Marietta when the deposit was withdrawn?

5. The Citizens National Bank of Abilene, Texas, had an account with the Central State Bank of Dallas, with the understanding that it was to receive $1\frac{1}{2}\%$ interest on the balance due at the end of each month for the number of days in the month. The following account shows a record of the transactions on the books of the Central State Bank of Dallas:

CITIZENS NATIONAL BANK, ABILENE, TEXAS

May	27	5000		May	1	16875	40
June	6	3000		May	10	3542	65
July	12	8416	42	June	16	21562	50
Aug.	22	5191	81	Aug.	1	5071	20
Sept.	16	852	40	Sept.	9	9982	50
Oct.	19	2761	85	Oct.	10	11451	90
Nov.	10	1000		Nov.	16	5000	
Dec.	12	5000		Dec.	5	3000	

You are to find the amount of interest that was credited to the Citizens National Bank of Abilene on December 31.

EXERCISE No. 191, REDISCOUNTING NOTES

When a bank has more notes than it can consistently carry and maintain the required cash balance, some of these notes may be discounted with another bank and thus exchange a part of the notes for cash. The Federal Reserve system provides for member banks rediscounting notes with the Federal Reserve Bank, also for taking up these notes at or before maturity. The process of a bank discounting a note with another bank is the same as that in which a depositor of the bank discounts a note with it. It is necessary to determine the maturity value of interest-bearing notes, and the present value by deducting from the maturity value the agreed interest for the time between the date of discount and maturity. The maturity value of an interest-bearing note is the face plus the interest to maturity; the maturity value of a non-interest-bearing note is the face. The present value of either is the maturity value less the interest from the date the note is discounted until maturity.

The following problems provide written practice in ascertaining the present value of notes which are rediscounted on September 1 at 4%. You are to show on tablet paper all the calculations necessary to find (a) the discount and (b) the present value of these notes.

No.	Date of Paper	Time	Int. Rate	Face	Due Date	Discount	Present Value
1.	Aug. 1	4 mos.	5%	$22,500.00			
2.	July 10	5 mos.	6%	9,861.42			
3.	Aug. 11	3 mos.	8%	289.27			
4.	July 31	3 mos.	5%	10,000.00			
5.	Aug. 12	60 days	No	2,561.47			
6.	July 2	90 days	5%	7,061.32			
7.	Aug. 1	3 mos.	8%	247.68			
8.	July 29	90 days	7%	1,122.41			
9.	Aug. 16	2 mos.	9%	798.91			
10.	June 1	6 mos.	6%	5,000.00			
11.	Aug. 11	2 mos.	5%	14,500.00			
12.	July 26	3 mos.	6%	1,200.00			
13.	May 31	5 mos.	No	387.95			
14.	July 10	5 mos.	7%	921.32			
15.	Aug. 13	90 days	5%	5,000.00			
16.	Sept. 1	4 mos.	6%	3,500.00			
17.	Aug. 3	4 mos.	8%	500.00			
18.	July 3	3 mos.	No	821.55			

EXERCISE No. 192, PURCHASE OF REDISCOUNTED NOTES

The bank which rediscounted the notes in the preceding exercise on September 1, repurchased the following notes on the date given, paying the maturity value less $4\frac{1}{2}\%$, the rate having changed since they were rediscounted.

No.	Note Number	Re-Purchased	Present Value	No.	Note Number	Re-Purchased	Present Value
1.	No. 12	Sept. 14		6.	No. 2	Sept. 25	
2.	No. 15	Sept. 20		7.	No. 18	Sept. 13	
3.	No. 1	Sept. 25		8.	No. 6	Sept. 6	
4.	No. 5	Oct. 1		9.	No. 3	Oct. 5	
5.	No. 10	Oct. 1		10.	No. 9	Sept. 6	

You are to show on tablet paper all the calculations necessary to obtain the amount of cash required to take up these notes. The process is the same as ascertaining the present value when they were discounted, except the time and rate have changed.

EXERCISE No. 193, SAVINGS BANKS

A *savings bank* is one which accepts money on deposit with an agreement to pay interest on the deposit, the interest to be compounded quarterly, semi-annually, or annually. Some banks do a strictly savings bank business while others maintain a savings department. Savings banks usually pay the agreed rate of interest from the first of the month on all funds deposited during the first four days of the month. Interest is compounded semi-annually, usually on January 1 and July 1. Money deposited after the fourth of the month will draw interest from the first of the month following the date of the deposit. No interest is payable for parts of a month, nor parts of a dollar, nor for any part of the preceding half year on amounts withdrawn during the interest period. In computing interest, withdrawals are deducted from the balance on interest at the beginning of the interest period, or if that is not sufficient, then from the first available balance within said period. When interest is due and payable, if not drawn out, it is added to the balance of the account and thereafter draws interest the same as on original deposits.

$100 deposited in a savings account on September 3, at an agreed rate of 4%, with interest compounded January 1 and July 1, would earn interest at this rate during September, October, November, and December. January

1, the interest for four months would be credited to the depositor's account. The interest on $100 for a year is $4; hence the depositor's account would be credited with interest, $1.33, on Jan. 1. If there were no deposits nor withdrawals during the next six months the 4% interest would be calculated on $101 (no interest is paid on parts of a dollar). If on March 2, $100 were deposited this would draw interest at 4% through March, April, May and June if no withdrawals were made. If on May 3, $50 were withdrawn this would be deducted from the balance at the beginning of the interest period January 1, leaving $51 which would draw interest in January and February. Since $100 was deposited on March 2, then $151 would draw interest during the months of March, April, May and June. The interest on $51 for two months at 4% is 34c. The interest on $151 for four months at 4% is $2.01. The depositor's account would be credited on July 1 with $2.35 interest (34c plus $2.01). The depositor's balance on July 1 would be $153.68 ($101.33 plus $100, minus $50, plus $2.35, interest), and this would be the principal at the beginning of the next interest period.

The following problems provide practice in ascertaining the balance due a savings bank depositor. You may assume that interest at the given rate is paid for the month on all deposits made on or before the fourth of the month and that the calculations are based on 1 month as $\frac{1}{12}$ of a year, 6 months as $\frac{1}{2}$ of a year, etc.

1. July 1, Harry Davis deposited $50 in the Central Savings Bank. This bank pays 4% interest and credits the interest July 1 and January 1 of each year. Mr. Davis made the following deposits: August 3, $200; September 1, $50; September 28, $50; October 3, $25; November 15, $100; January 2, $100; February 5, $50; March 1, $100; April 5, $50; May 1, $100; and June 1, $50. How much did he have in the bank July 1 after his account had been credited with the interest on the deposits?

2. The following is a record of the transactions which George H. Dutch performed with the savings department of the First National Bank during the period covered by the transactions. You are to ascertain the amount due on July 1 of the second year, interest compounded January 1 and July 1 at 4%. January 2, balance $261.85; January 5, deposited $75; February 3, deposited $50; February 25, deposited $50; March 3, deposited $100; April 2, deposited $250; May 1, withdrew $150; May 16, deposited $50; July 3, deposited $100; August 1, deposited $200; October 5, deposited $100; December 1, deposited $100; January 6, deposited $50; February 3, deposited $100; April 1 deposited $50; June 1, deposited $50.

3. A. C. Mabley opens an account with the savings department of the City National Bank on February 1, with a deposit of $100 and completed the following transactions during the remainder of the year: March 3, deposited $500; April 5, deposited $1,000; May 1, withdrew $500; June 1, deposited $300; July 15, withdrew $200; August 4, deposited $1,000; September 3, deposited $500; October 1, withdrew $1,000; October 5, deposited $200; November 1, deposited $200; December 5, deposited $500; December 20, withdrew $200. Ascertain the balance due Mr. Mabley on January 1 after crediting him with interest at 4% on July 1 and January 1.

4. L. W. Peart deposited $1,000 in the Central Savings Bank on January 1. On March 1, 5 years and 2 months thereafter he called at the bank to withdraw the amount due him. How much did he receive if the rate of interest was $3\frac{1}{2}\%$ compounded July 1 and January 1 of each year?

5. Mary E. Watson opened an account with the savings department of the Fourth National Bank on January 2, with a deposit of $10 and deposited the same amount monthly thereafter on the first of each month. How much was due at the end of 3 years with interest at 4% compounded semi-annually on January 1 and July 1?

6. Copy the account below on a sheet of tablet paper and insert (a) the amounts of interest, and (b) the balance due Mr. Muir on July 1, interest 4%.

EDWARD G. MUIR

Oct.	3	Check	200	July	1	Balance	236	65
Jan.	1	Check	100	July	2	Deposit	50	
				Sept.	12	Deposit	50	
				Dec.	2	Deposit	150	
				Jan.	1	Interest	?	?
				Jan.	5	Deposit	200	
				Mar.	1	Deposit	50	
				April	1	Deposit	50	
				July	1	Interest	?	?

CHAPTER XXII

PARTIAL PAYMENTS ON NOTES

When only a part payment is made on a note, before maturity, at maturity, or after maturity, the date and amount paid should be written on the back of the note. This writing is referred to as "indorsing for part payment". When a note is paid in two or more payments, it is necessary to adjust the interest at the time the balance of the note is paid. There are two methods of making this adjustment: one is known as the "Merchants' Rule"; and the other as the "United States Rule". The method to be followed will depend upon the agreement, or the law covering partial payments in the state in which the maker resides.

EXERCISE No. 194, MERCHANTS' RULE

This rule allows the holder of the note to collect interest on the face of the note from the time it begins to draw interest until the date it is paid in full, and requires him to deduct from the face of the note plus interest, the sum of the payments plus the interest on each payment from the date made to the day of settlement.

The illustration below shows the calculations necessary to ascertain the amount due on a ninety-day note of $500, dated May 16, with interest at 6%, and with the following payments entered on the back: August 14, $125; September 30, $100; November 24, $50. The maker wishes to pay the note in full on December 31 of the same year, and it is agreed to make settlement according to the Merchants' Rule.

Face of note			$500.00
Interest on $500 from May 16 to Dec. 31, 229 days			19.08
Amount due Dec. 31 if no payments had been made			519.08
PAYMENTS			
Interest from Aug. 14 to Dec. 31, 139 days, on $125,		$2.90	
Interest from Sept. 30 to Dec. 31, 92 days, on 100,		1.53	
Interest from Nov. 24 to Dec. 31, 37 days, on 50,		.31	
	$275 +	$4.74 =	279.74
Amount due Dec. 31 when payments are deducted			$239.34

The maker of the note pays interest on the face of the note from date to the day of settlement, because it is an interest-bearing note, but he receives credit for the sum of the payments and the interest on each payment from its date to the day of settlement.

The notes on pages 287–290 provide written practice in ascertaining the balance due on a definite date when partial payments are involved. You are to show on tablet paper all the calculations necessary to arrive at the balance due on each of these notes as required with the Merchants' Rule. Arrange your work in the same order as the illustration.

NOTE: You will use the exact number of days in all of the calculations. Compound subtraction could be used if desired, but since the tendency in business is to count the actual number of days where the time is less than a year, you will use the actual number of days.

EXERCISE No. 195, UNITED STATES RULE

This title is given to the rule, because it was first used by the United States government when payments and interest were involved; its approval by the Supreme Court of the United States has resulted in its legal adoption by many states. This rule is usually employed when partial payments are made on an interest-bearing note when the time exceeds one year. When this rule is used the date and amount of each payment is entered on the back of the note as a receipt. The balance due on the note after the first payment, is the principal when ascertaining the interest due when the second payment is made. The same plan is followed with the second payment, that is, the interest due at that time is taken out of the payment and the note credited only with the difference between the interest and the amount paid. The new principal is this balance which is used as a basis for ascertaining the interest due when the third payment is made. If a payment does not pay the interest due at the time it is made, the principal remains the same until the payment or payments are large enough to pay the interest due.

It is only when ascertaining the amount due at the time of settlement that the calculations are made to determine the amount of interest to be added to the principal from which the payments are to be deducted. The following illustration shows the method of ascertaining the balance due in the problem used as an illustration in the preceding exercise.

Face of the note	$500.00
Interest from May 16 to Aug. 14, 90 days, on $500.00	7.50
Amount due, August 14	507.50
Less Payment, August 14	125.00
New Principal, August 14	382.50
Interest from Aug. 14 to Sept. 30, 47 days, on $382.50	3.00
Amount due, September 30	385.50
Less Payment, September 30	100.00
New Principal, September 30	285.50
Interest from Sept. 30 to Nov. 24, 55 days, on $285.50	2.62
Amount due, November 24	288.12
Less Payment, November 24	50.00
New Principal, November 24	238.12
Int. from Nov. 24 to Dec. 31, 37 days, on $238.12	1.47
Amount due, December 31	239.59

Check this illustration with the facts given in the other illustrations and compare the two methods.

You will observe that the amount due on the date of the first payment is $500, the face of the note, and $7.50, the amount of the interest. The payment of $125 is deducted from this, leaving a new principal of $382.50 which is used as the base for calculating the interest from the date of the first payment to the date of the second payment. This is the same as subtracting the interest from the payment and subtracting this balance from the note to ascertain the balance due on the note, or the new principal.

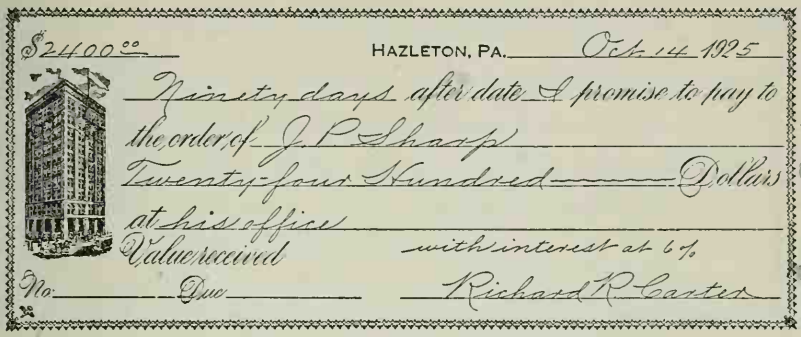
The interest on the new principal, $382.50, from August 14, the date of the first payment, to September 30, the date of the second payment, is $3, making the total amount $385.50. Deducting the payment of $100 made on September 30, leaves a balance of $285.50.

The interest on the new principal $285.50, from September 30 to November 24, the date of the third payment is $2.62, making the total amount due on November 24, $288.12. Deducting the payment of $50 made on November 24, leaves a balance of $238.12, the new principal on which interest is calculated.

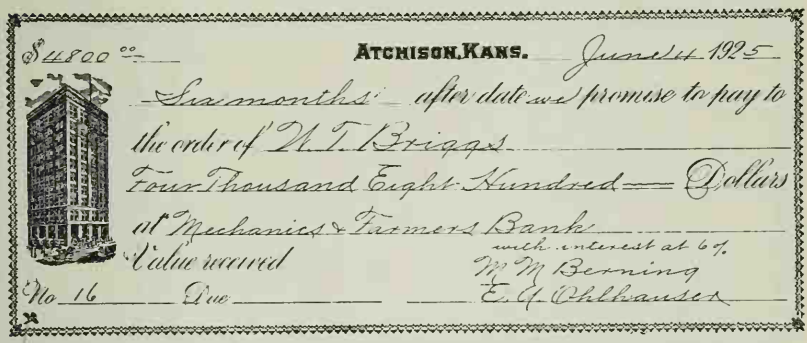
Since no further payments are made after November 24, the amount of interest due on December 31 is $1.47. The total amount due being $239.59.

The notes on pages 287–290 provide written practice in ascertaining the amount due on the date of settlement where interest and partial payments are involved and the United States rule is used. You will show on tablet paper all the calculations necessary to ascertain the desired facts. Arrange your work in the order of the illustration above.

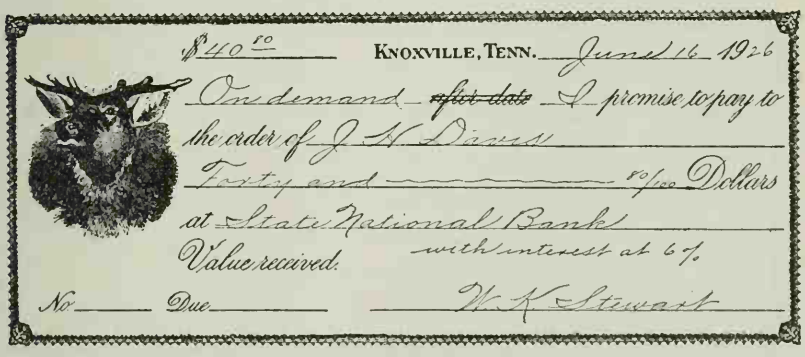
1. What is the amount due on the note below at maturity? See indorsements on the back (next page).

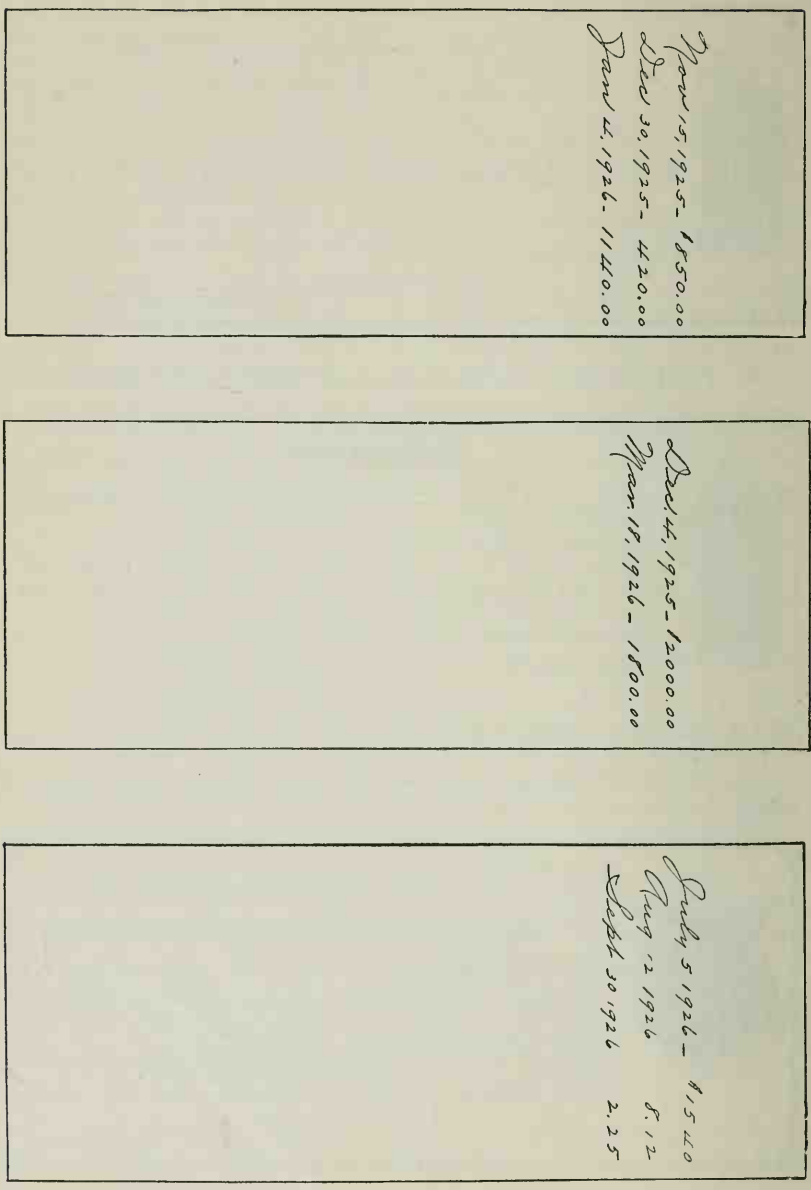

$2400.00 HAZLETON, PA. Oct. 14 1925
Ninety days after date I promise to pay to
the order of J. P. Sharp
Twenty-four Hundred Dollars
at his office
Value received with interest at 6%
No. Due Richard R. Carter

2. Find the balance due on April 11, 1926, on the note below.


$4800.00 ATCHISON, KANS. June 4 1925
Six months after date we promise to pay to
the order of W. T. Briggs
Four Thousand Eight Hundred Dollars
at Mechanics & Farmers Bank
Value received with interest at 6%
M. M. Berning
No. 16 Due E. A. Ohlhauser

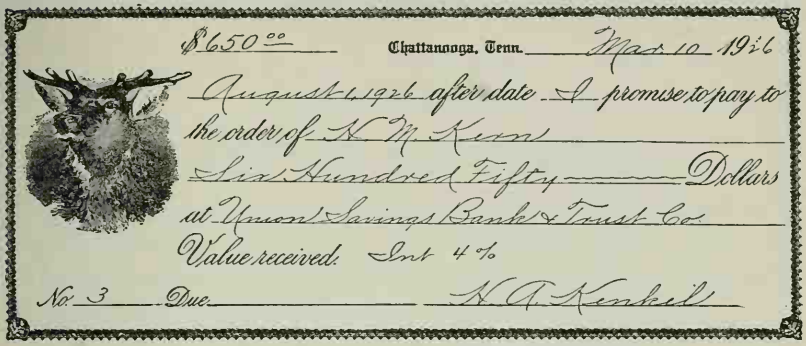
3. Find the balance due on the note below, November 4, 1926.


$40.80 KNOXVILLE, TENN. June 16 1926
On demand ~~after date~~ I promise to pay to
the order of J. H. Davis
Forty and 80/100 Dollars
at State National Bank
Value received with interest at 6%
No. Due W. K. Stewart



Endorsements of payments on notes on previous page.

4. Find balance due at maturity on the note below.



$650.00 Chattanooga, Tenn. May 10 1926

August 4 1926 after date I promise to pay to the order of K M Kerr

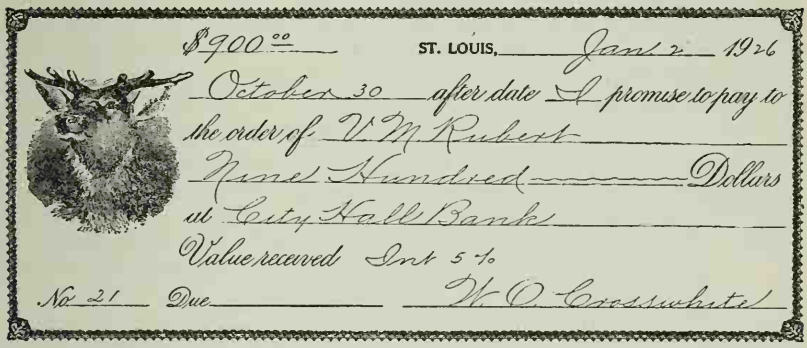
Six Hundred Fifty Dollars

at Union Savings Bank & Trust Co

Value received. Int 4%

No 3 Due K A Kenkel

5. What is the amount due October 30 on the note below?



$900.00 ST. LOUIS, Jan 2 1926

October 30 after date I promise to pay to the order of V M Rubert

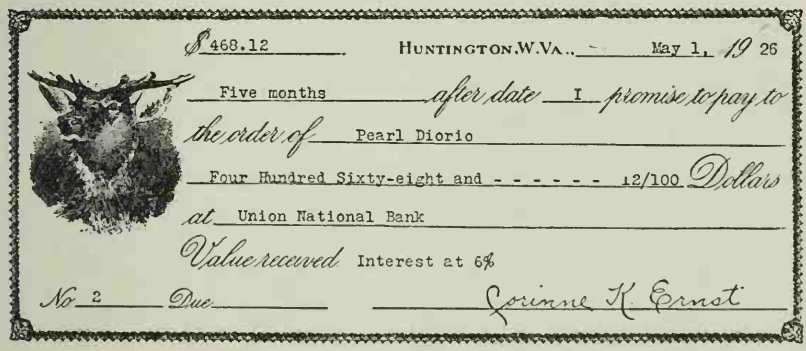
Nine Hundred Dollars

at City Hall Bank

Value received Int 5%

No 21 Due V O Crosswhite

6. What is the amount due December 1 on the note below?



$468.12 HUNTINGTON, W. VA., May 1, 19 26

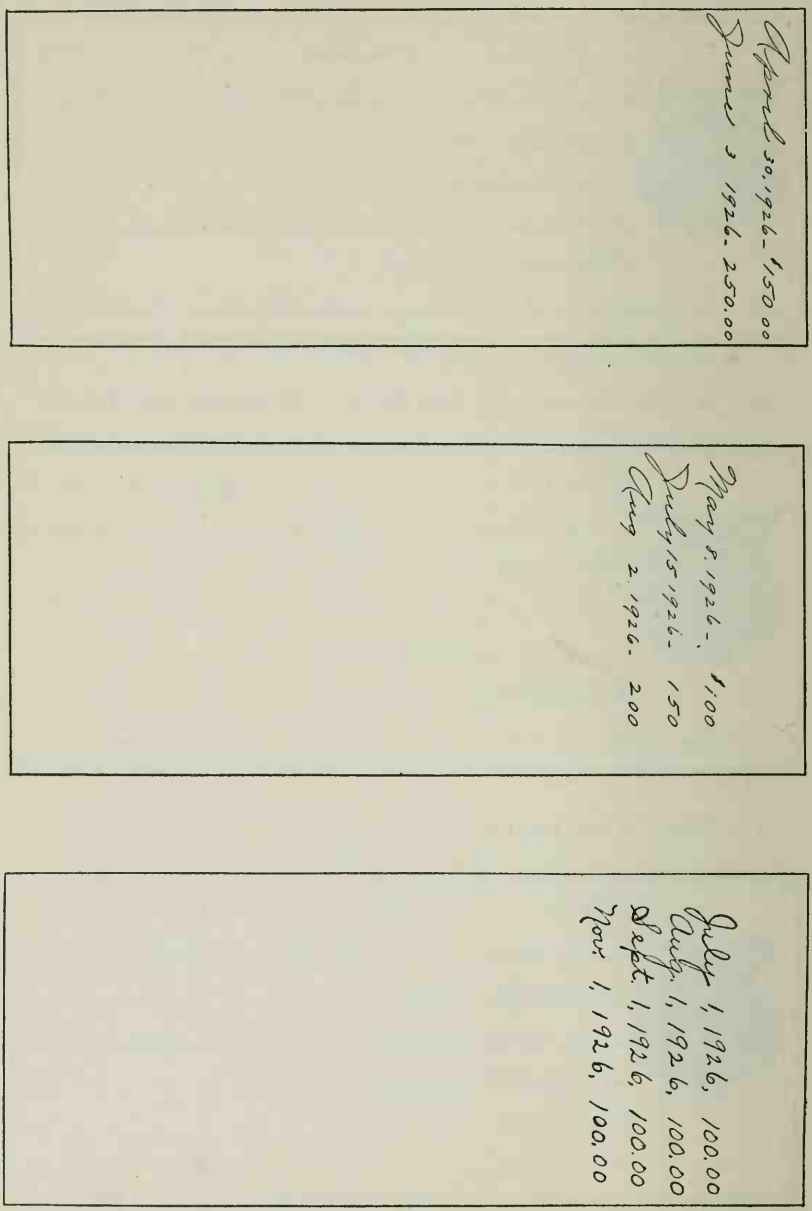
Five months after date I promise to pay to the order of Pearl Diorio

Four Hundred Sixty-eight and - - - - - - 12/100 Dollars

at Union National Bank

Value received Interest at 6%

No 2 Due Lorinne K Ernst



Endorsements of payments on notes on previous page.

CHAPTER XXIII

TRADE AND CASH DISCOUNTS

Trade discount is a deduction from the catalog or list price, usually stated in the form of one or more discounts. Its purpose is to provide for the fluctuation in the cost of raw material, labor, etc., in order that standard list prices may be provided.

The Standard Manufacturing Company, manufacturers of plumbers' supplies, issued a catalog in which were listed the various articles offered for sale to plumbers. The list price of a certain type of bath tub as shown in this catalog was \$160. Before a customer has a tub installed, he usually wishes to make a selection, and the plumber permits him to do this from the catalog. The price given in the catalog, \$160, is the price at which the plumber is supposed to sell it. However, the price to the plumber is given in a special confidential price list which shows the catalog price and the trade discount or discounts allowed.

Assuming that the discounts allowed by the Standard Manufacturing Company are 20% and 10%, the net cost of the bath tub to the plumber would be \$160 less 20%, or \$128 less 10%, or \$115.20. Each discount is deducted separately. The results are the same in this problem, whether the 10% is deducted first and then the 20%, or vice versa.

EXERCISE No. 196, TRADE DISCOUNT

The following problems provide oral practice in deducting trade discount.

	1	2
a.	\$100 less 10% and 10%	\$100 less 20%, 10% and 5%
b.	60 less 25% and 10%	80 less $12\frac{1}{2}$%, 10% and 10%
c.	35 less 40% and 10%	150 less 20%, 20% and 20%
d.	100 less 20% and 10%	200 less 20%, 10% and 10%
e.	100 less 20% and 10%	100 less 15% and 5%
f.	200 less 25% and 10%	125 less 20%, 20% and 10%
g.	400 less 40% and 20%	150 less $33\frac{1}{3}$%, 20% and 10%
h.	75 less 20% and 20%	200 less 50%, 40% and 10%
i.	80 less 10% and 10%	60 less 50%, 40% and 50%
j.	90 less 20% and 20%	30 less 10%, 10% and 10%
k.	75 less $33\frac{1}{3}$% and 10%	40 less 50%, 20% and 10%

EXERCISE No. 197, TRADE DISCOUNT

When a written solution is necessary to ascertain the net price when trade discounts are involved, one of the four methods illustrated in this and the succeeding exercises may be used. It is customary in business, to consider five mills or more in the discount as a cent; if less than five mills, to discard it. You will also observe that the final results are the same regardless of the order in which the discounts are deducted.

The illustration below shows the method of ascertaining the net price when each discount is deducted separately. The solution shows the method of ascertaining the net price of six machines listed at \$140 each, with trade discounts of 25% and 15%.

\$840	\$630
.25	.15
4200	3150
1680	630
\$210.00	\$94.50
\$840	\$630.00
\$210	94.50
\$630	\$535.50

The first discount is obtained by multiplying the total list price by the discount expressed as a decimal fraction. The net price after deducting the first discount is \$630. The second discount is obtained by multiplying the second list price by the second discount. The net price after deducting the second discount is \$535.50, the net price of all the machines. When more than one item is involved, calculate the discounts on the total list price of all the items.

The following problems provide written practice in finding the net price when the list price and the trade discounts are given. Show on tablet paper all of your calculations necessary to ascertain the net price in each problem, arranging your work in the same order as in the illustration. Prove the correctness of your solution by deducting the discounts in the reverse order.

1. List price, \$140, less 25% and 15%. What is the net price?

2. What is the net cost of 25 stoves listed at \$22.40 each, with discounts of 18% and 10%?

3. List price, \$44.50, discounts, 15% and $12\frac{1}{2}\%$. What is the net price?

4. What is the net cost of a radio which is listed in a catalog at \$92.50 less discounts of 25%, 5% and 5%?

5. List price, \$196, discounts, 20%, $12\frac{1}{2}\%$ and 5%. What is the net price?

6. What is the net price of 8 wash stands listed at \$32.50 each, with discounts of 25%, 20%, 10%, $7\frac{1}{2}\%$ and 5%?

EXERCISE No. 198, TRADE DISCOUNT

When the rate of discount is an aliquot part of a dollar the discount may be ascertained by dividing the list price by the denominator of the fraction representing the aliquot part. Deducting the discount obtained by this operation from the list price will give the net price.

The illustration below shows the method of applying aliquot parts to ascertain the net price of a radio outfit listed at \$290, with discounts of 25%, $16\frac{2}{3}$%, and $12\frac{1}{2}$%.

4)\$290.00	\$217.50
72.50	36.25
	8)\$181.25
\$290.00	22.66
72.50	\$181.25
6)\$217.50	22.66
36.25	\$158.59

The first net price is ascertained by dividing the list price by 4 (25% is $\frac{1}{4}$ of 100), and subtracting the quotient from the list price. The second net price is ascertained by dividing the first net price by 6 ($16\frac{2}{3}$% is $\frac{1}{6}$ of 100), and subtracting the quotient from the first net price. The third net price is ascertained by dividing the second net price by 8 ($12\frac{1}{2}$% is $\frac{1}{8}$ of 100), and subtracting the quotient from the second net price. This gives the desired net price, because there are only three discounts allowed.

The following problems provide written practice in ascertaining the net price when the list price is given, and the trade discounts are an aliquot part of a dollar. A combination of this method with the one given in the preceding exercise will give the same results. Thus, if only one of the discounts in the series is an aliquot part of a dollar, division may be used instead of multiplication. Prove your calculations by the method illustrated in Exercise No. 197.

1. The list price of a stove was \$162.50, with trade discounts of $16\frac{2}{3}$% and 5%. What was the net price?

2. What was the net cost of three radio outfits listed at \$350 each, with trade discounts of $12\frac{1}{2}$%, 5% and 2%?

3. The list price of a bookcase was \$185, less 20%, $12\frac{1}{2}$% and 5%. What was the net price?

4. What was the net cost of five suites of furniture listed at \$476 each, with trade discounts of 20%, $16\frac{2}{3}$%, 5% and 2%?

5. What would be the net cost of two pianos listed at \$1,680 each, with trade discounts of 25%, 20%, $12\frac{1}{2}$% and 5%?

6. The list price of an automobile was \$1,540, with trade discounts of 20%, $16\frac{2}{3}$%, $12\frac{1}{2}$% and 5%. What was the net price?

EXERCISE No. 199, TRADE DISCOUNT

If desired, the list price may be multiplied by the difference between 100 and the first rate; this product multiplied by the difference between 100 and the second rate, etc., until all the rates have been used; the final product will be the desired net price. The final results are the same with any of the four methods if the fractions of a cent are retained through all of the operations. When solving problems by this and the following method the results obtained in some problems may vary a few cents from the two preceding methods because of discarding and changing the fractions of a cent in the discounts.

The illustration below shows the process explained above applied to finding the net price of a refrigerator listed at \$240 with trade discounts at 35% and 15%.

\$240	\$156
.65	.85
1200	780
1440	1248
\$156.00	\$132.60

The first net price is ascertained by multiplying the list price by .65, which is 100% minus 35%. The second net price is the product of \$156 multiplied by .85, which is the difference between 100% and 15%. This product is the desired net price, because only two discounts are allowed.

The following problems provide written practice in finding the net price when the list price and the trade discounts are given. Show on tablet paper all of your calculations necessary to ascertain the net price in each problem, arranging your work in the same order as in the illustration. Prove your solution by using the method illustrated in Exercise No. 197.

1. List price, \$4.50, discounts, 15%, 10%, 10%, 5%, 5% and 5%. What is the net price?

2. What is the net price of 32 dozen hatchets listed at \$9.75 per dozen, with discounts of 20%, $12\frac{1}{2}$%, 10%, 5% and 5%?

3. List price, \$182.50, discounts, 25%, 15%, $12\frac{1}{2}$%, 10%, 5% and 5%. What is the net price?

4. What is the net cost of 9 refrigerators listed at \$65.50 each, with discounts of 20%, 15%, $12\frac{1}{2}$% and 10%?

5. List price, \$48.50, discounts, 25%, 15% and $12\frac{1}{2}$%. What is the net price?

6. What is the net cost of 6 automobile tires listed at \$47.50 each, with discounts of 40%, $33\frac{1}{3}$%, 5% and 5%?

EXERCISE No. 200, TRADE DISCOUNT

The per cent value of the list price after deducting a series of discounts may be ascertained and the list price multiplied by this per cent value to obtain the net price.

The illustration below shows the method of finding the net price of a desk listed at $165 with discounts of 15% and 15%.

1.00	$165
.15	.7225
.85	825
.85	330
425	330
680	1155
.7225	$119.2125

Each rate is deducted separately from 100%. The differences are multiplied together. The product will give the equivalent per cent value of the list price. Multiplying the list price by this result gives the desired net price. Deducting the per cent value obtained from 100% will give the net value of the series of discounts. 100% − 72.25% = 27.75%; this is the one discount equivalent to the discount series.

The following problems provide written practice in applying the above method. Show on tablet paper all of the calculations necessary to ascertain the result of each problem. Arrange your work in the same order as in the illustration. Show proof of your results by using one of the methods given in the preceding exercises.

1. What would be the cost of six kitchen cabinets listed at $78.50 each, with discounts of 15% and 5%?

2. What single discount is equivalent to 20%, 15% and $12\frac{1}{2}$%?

3. What is the net price of eight overstuffed chairs listed at $125 each, with discounts of $16\frac{2}{3}$%, 10% and 5%?

4. A dealer paid $861.84 for an automobile on which he was allowed discounts of 20%, 10% and 5%. What was the list price?

5. What would be the cost of three vacuum cleaners listed at $57.80 each, with discounts of 15% and 2%?

6. The list price of a rug was $360, with discounts of $16\frac{2}{3}$%, $12\frac{1}{2}$% and 5%. What was the net price?

7. What one discount will express the value of: (a) 65%, 35%, and 10%; (b) 90%, 10% and 5%; (c) 75%, 75% and 10%; (d) 25%, 25%, 10% and 5%; (e) 45%, 40%, 30% and 25%; (f) 50%, $33\frac{1}{3}$%, 25%, 20%, $16\frac{2}{3}$%, $12\frac{1}{2}$% and 10%?

8. What would be the cost of a typewriter listed at $120 with discounts of 20% and 5%?

EXERCISE No. 201, CASH DISCOUNT

Cash discount refers to a discount allowed for prompt payment. It is assumed that a customer will make an effort to pay his bill within a specified time, if by so doing he can secure a deduction from the amount through a cash discount allowed. Cash discount has no connection with trade discount. If there are trade discounts applicable to the list price of an article, the net price which is the list price less the discounts, is used in the extension of the invoice.

The cash discount is usually indicated on the invoice as a part of the terms of purchase. Thus, "2/10, n/30" indicates that the purchaser may deduct 2% from the amount of the invoice, if he pays within ten days from the date of the invoice; but if he does not pay within that time, the full amount will be due 30 days from the date of the invoice.

The following problems provide oral practice in ascertaining the amount of the cash discount. This is ascertained by multiplying the amount of the invoice by the rate expressed as a decimal fraction. The amount of the invoice is given in the first column and the rate per cent in the second.

	1		2		3	
a.	$180.00,	2%	$212.50,	2%	$ 97.50,	1%
b.	250.00,	1%	300.00,	4%	98.15,	1%
c.	35.00,	2%	125.00,	5%	27.65,	2%
d.	120.00,	3%	160.00,	2½%	36.00,	2½%
e.	225.00,	1%	180.00,	1½%	88.50,	1%
f.	38.50,	1%	22.50,	2%	19.29,	1%
g.	209.65,	1%	35.65,	1%	212.50,	2%
h.	9.85,	1%	204.00,	2%	99.00,	2%
i.	35.25,	2%	308.00,	1½%	75.50,	1%
j.	150.00,	3%	115.00,	3%	99.80,	1%

EXERCISE No. 202, CASH DISCOUNT

When an invoice subject to discount is paid in full, the amount required to pay it is ascertained by multiplying the amount of the invoice by the rate per cent stated in the terms, and deducting the discount from the amount of the invoice. It is quite evident that the purchaser expects the amount he pays to cancel the full

amount of the invoice, hence his account would be credited with the cash and the cash discount. When only a part of an invoice, subject to discount, is paid within the discount period, the purchaser is entitled to a discount on the amount paid. If the terms are, 2%, 10 days, and he pays part of his account within that time, each 98c he pays entitles him to a credit of $1.00. This means that the amount of the payment is divided by .98, to ascertain the amount with which his account will be credited. The difference between the amount he pays and the amount with which he is credited is the cash discount.

The following problems provide written practice in the application of cash discount. The first column shows the date; the second, the amount of the invoice; the third, the terms; the fourth, the date of payment; and the fifth, the amount paid. You are required to show the amount of the cash discount.

	Date	Amount	Terms	Payment	Amount Paid	Discount
1.	Jan. 2	$216.40	2/10, n/60	Jan. 9	In full	
2.	May 4	909.16	1/30, n/60	June 3	In full	
3.	Feb. 9	475.85	3/10, n/30	Feb. 19	$300	
4.	Oct. 6	98.60	2/30, n/60	Nov. 5	In full	
5.	Nov. 2	752.60	3/10, n/30	Nov. 10	$500	
6.	Jan. 11	55.65	2/10, n/30	Jan. 20	In full	
7.	Apr. 4	317.65	1½/10, n/30	Apr. 13	$200	
8.	May 9	455.08	1/30, n/90	June 7	In full	
9.	June 4	396.55	2/30, n/60	July 2	$300	
10.	Dec. 1	508.16	1/10, n/30	Dec. 10	In full	
11.	Feb. 11	87.55	3/30, n/60	Mar. 8	In full	
12.	Sept. 6	115.55	2/30, n/60	Oct. 1	In full	

EXERCISE No. 203, TRADE AND CASH DISCOUNTS

The following invoices provide further practice in (a) auditing extensions, (b) auditing trade discounts, and (c) ascertaining the amounts necessary to pay the invoices in accordance with the terms. Show on tablet paper all the calculations necessary to verify the extensions and trade discount, and ascertain the net amount necessary to pay each invoice, less the cash discount.

1.

Cutlery
Revolvers
Fire Arms
Ammunition
Bicycle Sundries
Fishing Tackle
Hardware Specialties
Paints—Varnishes
House Furnishings
Sargent's Builders' Hardware

TELEPHONES | MAIN 2505 | MAIN 2606

The Evans Bros. Hardware Co.

FINE TOOLS

:: FOR ALL TRADES ::

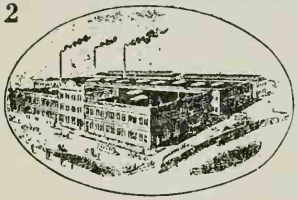
Fifth and Elm Streets, Cincinnati,
Nov. 20, 1926

Sold to G. W. Harvey
Okeana, Wis.

TERMS 2/10, n/30

17½	Doz. Miners Hoes	$6.40 per doz.	112				
	Less 20% and 5%		26	88	85	12	
500	Coal Picks, special	7.80 " "	325				
	Less 5%, 2% and 1%		25	46	299	54	
1420	Just Right Shovels	125.40 per C	1790	68			
	Less 33 1/3% and 2½%		622	24	1157	44	
					1542	10	
	Freight Prepaid				140	27	
					1682	37	

2



E. C. SIMMONS HARDWARE CO.

CUTLERY
REVOLVERS
FIRE ARMS
AMMUNITION
BICYCLES
SUNDRIES

FINE TOOLS
FOR ALL TRADES

Oct. 11, 1926 ST. LOUIS

Sold to C. R. Bader,
Cincinnati, Ohio.

Shipped via Frt. Prepaid
Terms 2/10, n/30

24½	Doz. X. L. Garden Hoes	$5.50	134	75			
120	16" Steel Rakes each	.86 2/3	104				
1 5/6	Doz. Lawn Mowers "	22.75	500	50	739	25	
	Less 10, 5 and 2%				119	84	
					619	41	
	Freight Prepaid and charged				15	20	
					634	61	

3.

ESTABLISHED 1864

A. M. BYERS COMPANY

MANUFACTURERS OF

GENUINE WROUGHT IRON PIPE AND OIL COUNTRY TUBULAR PRODUCTS

PITTSBURGH, PA.

CONSIGNEE
ADDRESS
VIA

INVOICE NO.

DATE August 27, 1926.

SOLD TO: E. H. Mason & Son,
Sharonville, Ohio.

TERMS Draft 30 days.

CAR NO. 88300 WEIGHT F. O. B. Pgh.

CUSTOMERS ORDER NO	BOLS	PIECES	SIZE	DESCRIPTION	FEET	IN.	PRICE	AMOUNT	TOTAL AMOUNT
		4	2	Ex. Hvy Gal Ran Pipe 7.5 & 5%	80		.50½	40.40 3.03	36.37
		2	1¼	DO Pe Bw 8.5 & 5%	114		.30	34.20 4.49	29.73
		8	1	DO Pe Bw 8.5 & 5%	810		.22	178.20 23.30	155.80
		3	3/4	DO Pe Bw 8.5 & 5%	416		.15	62.40 8.15	54.25
									275.15

J A CHURCH, President — A T NESBITT, Vice President — E W CHURCH, Sec'y — L L EVANS, Treas.

4.

The Cincinnati Cordage & Paper Co.

DEPENDABLE C&P Co.

Paper and Twine

No 128 EAST SIXTH ST CINCINNATI
No 535 EAST THIRD ST DAYTON

CINCINNATI Nov. 12, 1926

TERMS: 30 days SOLD TO Standard Publishing Co.,
Ninth & Plum Sts.,
Chicago, Ill.

Accounts to be settled Monthly

SHIPPED VIA: F O B Cin.

No Claims allowed on this Bill unless made within Five Days after receipt of Goods. Pay nothing to Agents unless by our written Authority.

25	M American Linen Billheads	2.35 per M.	58	75	
	Less 5%		2	94	55.81
25	M 4 ply #117 Corner Cards	2.10 " "	52	50	
	Less 5%		2	73	49.77
50	M 5 ply #88 Round Corner Cards	1.05 " "	52	50	
	Less 10 & 5%		7	62	43.88
12	M #10 White Wove Envelopes 28 lb.	2.28 " "	27	36	
	Less 5%		12	69	14.68
					164.14

5.

ESTABLISHED 1864

A. M. BYERS COMPANY

MANUFACTURERS OF

GENUINE WROUGHT IRON PIPE AND OIL COUNTRY TUBULAR PRODUCTS

PITTSBURGH, PA.

CONSIGNEE
ADDRESS
VIA

INVOICE NO

DATE July 20, 1926.

SOLD TO Wroth & Co.,
Pueblo, Colo.

TERMS Draft 30 days

CAR NO. CNJ 88299 WEIGHT F O B Pgh.

CUSTOMERS ORDER NO	BDLS	PIECES	SIZE	DESCRIPTION	FEET	IN.	PRICE	AMOUNT		TOTAL AMOUNT
		30	3	Blk Ran Pipe T&C	636		.76½	486	67	
				30½%				148	43	338.24
		20	10"	-35# DO	408		3.50	1428		
				27½%				391	70	1026.30
		20	12"	-45# DO	397		4.50	1786	50	
				25%				446	63	1339.87
										2754.41

EXERCISE No. 204, CASH DISCOUNT

The following problems provide written practice in applying the principles of cash discount, and the application of other principles discussed in previous chapters.

1. May 16, The Holmes Furniture Company purchased from the Grand Rapids Furniture Company a bill of furniture amounting to $1,847.65. According to the terms of this purchase the Grand Rapids Furniture Company was to prepay the freight and charge the Holmes Furniture Company with only one half of it. The invoice mentioned includes the value of the merchandise and one half of the freight, $188.56. The terms of the bill were 3/30, n/60. June 14, the cashier of The Holmes Furniture Company issued a check in payment of this bill in accordance with the terms. You are required to show on tablet paper all of the calculations necessary to determine the amount of this check. You may assume that The Holmes Furniture Company understands it would not be fair to deduct discount on prepaid freight.

2. August 19, The Central Hardware Company purchased hardware invoiced at $1,627.56, from the Simmons Hardware Company, terms, 2/30, n/60. When the merchandise was delivered, the management of The Central Hardware Company discovered that an error had been made in ordering additional stock of one item when this was not needed, and asked the Simmons Hardware Company for the privilege of returning merchandise, the value of which was $248.50. September 10, a credit bill was issued for the value of this returned merchandise. September 16, the cashier of The Central Hardware Company issued a check in payment of the amount due the Simmons Hardware Company. You are to show on tablet paper all the calculations necessary to determine the amount of this check.

3. June 12, The Globe Clothing Company purchased clothing amounting to $3,856.90, from The Crown Clothing Company. The terms of the invoice rendered by The Crown Clothing Company were October 1, 3/10, 2/30, n/60; these terms indicate that 3% may be deducted if payment is made on or before October 11, 2% on or before October 31, and no discount thereafter. The Globe Clothing Company could not pay the bill in full, October 9, but sent a check for $2,000 to apply as part payment. October 30, they sent another check for $1,000, and December 1, a check for

the balance. You are to show on tablet paper all the calculations necessary to ascertain the amount of the last check.

4. July 9, The Watson Supply Company purchased 6 desks from the Dietz Desk Company at $148.50 each, with trade discounts of 15%, 10%, and 5%. The desks were billed at the net price, subject to 3% cash discount, if paid within 10 days. July 18, a check was issued in payment of these 6 desks. August 1, the receiving clerk of The Watson Supply Company reported to the manager that one of the desks was in bad condition. The manager wrote to the Dietz Desk Company and asked for an adjustment. The Dietz Desk Company suggested that the desk be returned and they would send a check for the amount The Watson Supply Company had paid for it. This suggestion was made by the Dietz Desk Company because they did not have in stock another desk to replace the one damaged and it seemed only fair that The Watson Supply Company should have a check to close the account. You are to show (a) all the calculations necessary to ascertain the amount of the check issued by The Watson Supply Company, July 18, and (b) the amount of the check received from the Dietz Desk Company in payment of the desk which was returned per agreement.

5. April 6, The Central Publishing Company purchased paper billed at $2,122.65, from The Woods Paper Company. The terms were July 1, 3/10, 2/30, n/60, paper delivered at the freight station of The Central Publishing Company. April 9, the paper was delivered with a freight bill of $209.65. The notation on the invoice of The Woods Paper Company, "receipted freight bill will be accepted as part payment of this invoice," authorized the Central Publishing Company tc pay the freight and charge it to the Woods Paper Company. July 9, The Central Publishing Company paid $1,200 on this purchase. July 25, the Woods Paper Company asked for the privilege of drawing a 60-day draft for an amount, which when discounted at 7% will produce the balance due. July 27, permission was granted, and the draft was drawn payable 60 days after date. The Central Publishing Company accepted this draft on July 29. You are to show on tablet paper all the calculations necessary to determine the amount of this draft.

CHAPTER XXIV

PROBLEMS OF A MERCHANT

The problems of a merchant which can be solved by arithmetic are varied and numerous. Some of them have been illustrated in preceding chapters. Others will be illustrated in this chapter. These problems require the application of the four fundamental operations to integers, fractions, and mixed numbers, including aliquot parts, percentage, and interest.

EXERCISE No. 205, PROFIT ON MERCHANDISE SOLD

It is not always possible for the merchant to know the exact cost of merchandise sold in each sale, but to ascertain his profit, it is necessary for him to know the total cost of all sales. This information is usually ascertained at least once each business year. To determine the cost of merchandise sold and the profit made by selling, it is necessary to record the value of merchandise on hand at the beginning of the year (referred to as the *beginning inventory*), the purchases during the year (referred to as *purchases*), the sales during the year (referred to as *sales*), and the value of merchandise on hand at the end of the year (referred to as the *ending inventory*). With these facts available, the profit made by selling merchandise throughout the year (referred to as *profit on sales*) may be ascertained by addition and subtraction.

The illustration below shows the method of ascertaining: (a) cost of goods sold; (b) the profit on the goods sold.

Sales		$18,987
Beginning Inventory	$ 3,427.65	
Purchases	12,192.00	
Cost of Merchandise Available for Sales	15,619.65	
Ending Inventory	3,116.65	
Cost of Merchandise Sold	12,503.00	12,503
Profit on Sales		$ 6,484

The sales are shown first, because the cost of the merchandise sold is to be subtracted to find the profit on sales. The sum of the beginning inventory

and purchases is the value of the merchandise available for sale. The difference between the value of the merchandise for sale and the ending inventory is the cost of the merchandise sold. The difference between the sales and the cost of merchandise sold is the profit on sales.

If the cost of the merchandise sold is more than the selling price, the difference between the selling price and the cost would be a loss. In a previous exercise you were told that sometimes the position of the numbers made it necessary to subtract the top number from the bottom one; a loss on merchandise sold would illustrate the comment in the second sentence of the first paragraph under Exercise No. 31.

The following problems provide written practice in ascertaining the profit or loss on the merchandise sold during a business year. Arrange your work on tablet paper as in the illustration.

	Beginning Inventory	Purchases	Sales	Ending Inventory
1.	$2,782.11	$ 6,941.66	$12,722.81	$2,642.11
2.	5,421.65	10,786.50	20,465.54	7,511.18
3.	4,005.52	12,076.55	25,581.19	1,276.54
4.	7,926.42	10,029.17	18,041.55	2,165.11
5.	562.55	9,487.36	15,078.91	1,005.76
6.	1,751.36	5,649.54	16,129.86	705.30
7.	2,020.20	6,979.59	22,201.36	1,591.12
8.	7,256.91	13,764.18	18,007.63	1,741.15

EXERCISE No. 206, PROFIT ON MERCHANDISE SOLD

When a part of the merchandise purchased is returned to the one from whom it was purchased, this is referred to as *purchases returns;* when a part of the merchandise sold to a customer is returned, this is known as *sales returns.* The *gross purchases* is the total purchases; the *net purchases* is the difference between the gross purchases and the purchases returns. The *gross sales* is the total sales; the *net sales* is the difference between the gross sales and the sales returns.

It is not always advisable for a merchant to refuse to accept merchandise returned by customers, because satisfied customers are essential to the success of any business, and allowing a customer to return a part of the merchandise, when his request to do so is reasonable, will help to keep him satisfied. The owner of a business is interested in the volume of purchases returns and sales returns, because this is, to a certain extent, a measurement of the efficiency of his creditors and of his efficiency in serving his customers.

The illustration below shows one method of arriving at the net cost of merchandise sold when purchases returns and sales returns are involved. The problem illustrated in the solution is as follows: beginning inventory, $3,227.66; gross purchases, $8,721.94; purchases returns, $964.78; gross sales, $25,927.36; sales returns, $675.36; ending inventory, $2,165.42; the facts regarding the sales are shown first to facilitate subtraction.

Gross Sales	$25,927.36		
Less Sales Returns	675.36		
Net Sales			$25,252.00
Beginning Inventory		$ 3,227.66	
Gross Purchases	8,721.94		
Less Purchases Returns	964.78		
Net Purchases		7,757.16	
Cost of Goods for Sale		10,984.82	
Less Ending Inventory		2,165.42	
Cost of Goods Sold			$ 8,819.40
Profit on Sales			$16,432.60

The following problems provide written practice in ascertaining the profit on merchandise sold during a business year when returned purchases and returned sales are involved. Arrange your work on tablet paper as in the illustration.

	Begin. Invent.	Purchases	Pur. Ret.	Sales	Sales Ret.	End. Invent.
1.	$1,654.55	$ 5,446.25	$125.68	$16,146.25	$234.47	$ 608.28
2.	5,623.64	10,784.48	135.45	20,756.82	178.36	7,566.35
3.	7,845.56	10,147.58	243.55	18,467.28	204.57	2,574.81
4.	8,256.93	14,764.38	225.53	19,008.38	89.84	1,842.75
5.	2,782.13	8,465.67	147.62	13,584.27	148.56	2,563.18
6.	3,034.16	7,784.47	203.32	23,487.90	189.98	2,438.75
7.	664.47	9,574.57	74.32	15,473.72	88.82	1,014.55

EXERCISE No. 207, RATE PER CENT OF RETURNED MERCHANDISE

Perhaps the best method of presenting the facts regarding purchases returns and sales returns to the owner of a business, is to express each in the form of a rate per cent. The gross purchases is used as a base for ascertaining the rate per cent of the merchandise returned by the owner; the gross sales is used as a base for ascertaining the rate per cent of the merchandise returned by customers.

The following problems provide written practice in presenting to the merchant in percentage form, facts regarding merchandise returned to those from whom he bought it, and that returned to him by his customers. You will show on tablet paper all the calculations necessary to secure the desired results.

1. During the first six months of a business year, the Johnson Company bought merchandise to the value of $29,675.87, and returned to those from whom it was bought, $1,362.55. During the next six months of the same year the gross purchases were $37,902.51, and purchases returns, $1,675.92. You are to ascertain: (a) the rate per cent of returns for each of these two periods; and (b) from this determine whether the service rendered by creditors was more or less efficient during the second period, showing this measure of efficiency as a rate per cent.

2. The sales and sales returns as recorded on the books of the May Drug Company during two consecutive years were as follows:

Sales first year	$116,581.42
Sales returns	3,471.65
Sales second year	142,518.92
Sales returns	4,527.99

You are to show: (a) the per cent of returns each year; and (b) from this determine the per cent of increase or decrease in efficiency.

3. The total sales of the Martin Department Store for a year were $1,961,781 and the sales returns were $9,182.25. What per cent of the sales are the sales returns?

4. The Peters' Grocery Company's purchases for one year were $77,417.45, and the purchases returns were $3,721.92. What per cent of the goods purchased was returned?

5. The net sales of the Simrall Company after deducting the returns were $87,516.48. If the returns were $1\frac{3}{4}\%$ of the gross sales, what were the total sales?

6. The sales returns of the Quick Service Hat Company during one year were $187.65. If this amounted to $1\frac{1}{2}\%$ of the net sales, (a) how much were the net sales, (b) the gross sales?

7. The gross sales of the Williams Company for a month amounted to $18,751.41, and the sales returns to $2,161.75. What per cent of the gross sales was returned?

8. The gross purchases of the Hart Hardware Company for a year amounted to $40,400.55, and the purchases returns, $750.50. What per cent of the gross purchases was returned?

EXERCISE No. 208, FREIGHT COST

A merchant is interested in the freight cost of the merchandise he buys, because this is a direct increase in the cost of the merchandise. When comparing quotations, it is necessary to take into consideration freight cost as well as the prices quoted, unless the price is f. o. b. the buyer's freight station.

"f. o. b." means free on board. If the terms are f. o. b. the seller's freight station, the buyer pays the freight; if the terms are f. o. b. the buyer's freight station, the seller pays the freight.

The following problems provide written practice in securing for the merchant desired information regarding freight costs, and their effect on the cost of merchandise to be purchased. Show on tablet paper all the calculations necessary to secure the desired information.

1. Robert Biddle, a miller, wishes to buy 1,200 bushels of wheat. He received prices from three bidders located in different cities. Bidder No. 1 quotes a price of $1.07 per bushel f. o. b. his freight station; Bidder No. 2, $1.13¾, f. o. b. his freight station; Bidder No. 3, $1.04, f. o. b. his freight station. The freight rate on wheat from the freight station of Bidder No. 1 is $1.55¼ per hundred; No. 2, $1.35½; No. 3, $1.65¾. You are to show on tablet paper all the calculations necessary to find the net cost of this wheat from each bidder and designate the results in order, beginning with the lowest net delivered price.

2. The amount of an invoice was $762.48, and the freight was $35.20. What per cent of the invoice cost is the freight?

3. If the merchandise in problem No. 2 could have been purchased from a company not so far away and thus effected a saving of $15.65 in the freight, what would have been the per cent of saving on (a) the freight and (b) merchandise cost?

4. The freight rate on a consignment of merchandise was .87¾ per 100 pounds. What was the amount of the freight, if the shipment weighed 21,642 pounds?

5. The Day Company received from the C. & P. Railroad a check for $12.65, a refund in freight because of an error in the freight bill. If this check was 7½% of the freight paid, how much was paid?

6. The first-class freight rate between two cities was 77½c. The Interstate Commerce Commission ordered a reduction to 71½c. What was the per cent of saving because of that reduction?

7. $270.80 was paid as freight on a shipment weighing 37,352 pounds. What was the rate per hundred pounds?

8. If the freight rate between two cities is 47½c, and the express rate is $1.75, what will be the per cent of saving by freight on a shipment weighing 564 pounds?

EXERCISE No. 209, CASH DISCOUNT

As explained in the previous chapter, cash discount refers to the discount allowed for prompt payment. The discount which a merchant allows his customers is referred to as *discount on sales*, and the discount allowed the merchant by his creditors, as *discount on purchases*.

Since all of his creditors do not allow a discount on purchases, and since the same discount is not allowed by all, it is necessary to determine the rate per cent of purchases discount by treating the purchases as the base and purchases discount as the percentage. Since all customers do not take advantage of the discount offered for prompt payment, it is necessary to treat the total sales from customers who buy on account as the base, and the sales discount allowed as the percentage in order to determine the rate per cent of sales discount.

The following problems provide written practice in determining the rate per cent of purchases discount and sales discount.

1. During the business year the total sales on account of the A. R. Neil Company were $181,486.50, and the discounts allowed customers because of prompt payment, $1,581.75. It is desired to know the per cent of discounts allowed customers because of prompt payment.

2. During the same business year as in problem No. 1, the purchases on account of the A. R. Neil Company were $102,473.25, and the purchases discounts allowed because of prompt payment, $1,282.56. What was the per cent of purchases discounts?

3. During two consecutive years the facts regarding sales and sales discounts as recorded on the books of the Mabley Company were as follows: first year; sales on account, $75,261.98; discounts allowed customers, $1,050.75; second year; sales on account, $91,719.66; discounts allowed customers, $1,242.51. It is desired to know (a) the per cent of the sales discounts for the first year, and (b) the per cent of the sales discounts for the second year.

4. During a certain year the net sales on account of the Electric Shop were $259,642.55, and the sales discounts, $2,575.78. What per cent of the sales were the sales discounts?

5. The purchases discounts recorded on the books of Adair & Brown for a year were $2,961.55. What were the total purchases during the year, if this represents an average discount of $1\frac{1}{2}\%$?

6. The total sales on account of The Gem Store during a certain year were $86,421.75, and the discounts allowed customers for prompt payment during the same year, $1,146.55. What was the rate per cent of sales discount?

7. The Mason-Murdock Company does both a cash and a credit business. During one year the total net sales were $104,786.21, of which $21,416.42 were cash sales and the balance on account. All sales on account are billed subject to a discount of 1% if paid within 10 days. The sales discounts allowed customers who purchased on account and paid promptly were $562.83. (a) Find the total sales on account. What per cent of the total sales are (b) the cash sales, and (c) the sales on account? (d) What per cent of the sales on account are the sales discounts?

EXERCISE No. 210, TURNOVER

Turnover refers to the number of times a merchant sells his stock during a year. It is quite evident that this turnover is not so rapid in some lines of business as in others. A grocer will buy and sell bread or sugar more times during a year than a piano merchant will buy and sell pianos. A number of statistical papers have been prepared on the turnover of various lines of business. The information given in these tables is based on the actual experiences of merchants engaged in these lines of business over a period of many years. The following average turnover rates are given by the Bureau of Business of A. W. Shaw & Co.

General Lines	Turns per Year	Departmental Lines	Turns per Year
Grocery Store	10	Notions	9
Department Store	7	Women's Ready to Wear	6
Variety Store	6	Wall Paper	4.2
Drug Store	4.5	Men's Furnishings	4.2
Dry Goods Store	4	Underwear	4.1
Hardware Store	3.5	Hosiery	4
Furniture Store	3	Gloves	3.5
Shoe Store	2.1	Dress Goods	3.2
Clothing Store	2	Silks	3.1
Jewelry Store	1.5	Carpets	1.5

The rates given above are ascertained by dividing the average inventory for a series of years, or the average inventory for the beginning and ending of the current year, into the cost of the goods sold. Thus, the cost of the goods sold by a grocer should be ten times the average inventory, if he is to have the turnover shown in the above table. The average inventory should be based on a number of preceding years, unless the records show that the inventory is practically the same at the end of each year.

The illustration below shows the method of ascertaining the turnover when the beginning inventory is $3,427.65, ending inventory, $3,116.65, and net cost of the merchandise sold during the period, $12,503.

$3,427.65
3,116.65
2)6,544.30
3,272.15
12,503 ÷ 3,272.15 =
3.82, or turnover

In the illustration at the left the beginning inventory, $3,427.65, and the ending inventory, $3,116.65 are added and divided by two to find the average inventory. The cost of the merchandise sold, $12,503, is divided by the average inventory to find the turnover, 3.82, or the number of times the merchandise bought by this merchant was turned over during the business year represented.

The following problems provide written practice in ascertaining turnover. You are to show on tablet paper all the calculations necessary to arrive at the turnover required, arranging your work in the same order as in the illustration. When the cost of the merchandise sold must be ascertained, show your calculations.

1. The inventories of the Lippincott Company at the end of each of five years were as follows: $1,762.92; $1,837.34; $1,854.44; $2,005.18; and $1,762.86. The cost of the merchandise sold during the current year was $18,965.48. What was the rate of turnover expressed as a mixed number with the decimal fraction in hundredths?

2. The following information appeared on the books of the A. B. C. Company at the end of the current business year:

Inventory of merchandise on hand at beginning of the year	$ 7,962.75
Purchases during the year	21,648.55
Freight on merchandise purchased	892.94
Returned purchases	572.36
Inventory of merchandise on hand at end of the year	8,721.65

It is desired to know the rate of turnover.

NOTE: The net cost of merchandise purchased is the total purchases less purchases returns, plus the freight. In other words, the cost of the merchandise purchased during the year is the invoice cost, plus freight, less returns.

3. The cost of the merchandise sold by Northcutt & Barnett was $21,678.48 and the average inventory was $5,426.54. It is desired to know the rate of turnover.

4. The rate of turnover of the Cash Grocery Company for the current year was 9.65. The average inventory for the preceding five years was $16,487.27. It is desired to know the cost of the merchandise sold for the current year.

5. The cost of the goods sold by the A. B. Campbell Company during the current year was $89,462.75, and the rate of turnover was 7.87. What was the average inventory?

6. The beginning inventory of the Bingham-Richards Company was $10,211.56; purchases, $18,562.48; freight, $419.75; return purchases, $275.54; and ending inventory, $9,981.64. What was the rate of turnover?

7. If the average inventory of Burkhardt Brothers, dealers in men's furnishings, is $21,515.40, and the rate of turnover during the current year was that shown in the table, what was the cost of the merchandise sold during the year?

8. At the close of the current business year, the cost of merchandise sold during the year by the Jones Grocery Company was $48,261.75, and the average inventory for the past five years was $5,548.28. What per cent less is the actual turnover than the turnover shown by the table?

EXERCISE No. 211, OPERATING EXPENSES

If a merchant is to make a profit, his selling price must be greater than the cost of the merchandise sold, plus the cost of operating expenses. The cost of merchandise sold was explained in Exercise No. 205. The operating cost may be divided into two general classes, *selling expense* and *general expense.* Selling expense includes salaries of the sales clerks, advertising, cost of maintaining a delivery department, etc.; general expense includes rent, office supplies, office salaries, etc. The excess of *profit on sales* over *expenses* is referred to as *net profit.*

The illustration below shows the method of ascertaining the net profit when the profit on sales and the operating expenses are known. The solution shows the method of arriving at the net profit when the profit on sales is $12,101.76; salaries of sales clerks, $2,846; store supplies, $151.50; advertising, $350; rent, $900; office supplies, $42.50; office salaries, $4,287.75; miscellaneous expense, $51.75. The profit on sales is shown first to facilitate subtraction.

Profit on Sales			$12,101.76
Salaries of Sales Clerks	2,846.00		
Store Supplies	151.50		
Advertising	350.00		
Total Selling Expenses		3,347.50	
Rent	900.00		
Office Supplies	42.50		
Office Salaries	4,287.75		
Miscellaneous	51.75		
Total General Expenses		5,282.00	
Expenses			8,629.50
Net Profit			$ 3,472.26

The profit made by selling merchandise is entered at the right. The selling expenses are grouped and added. The general ex-

penses are grouped and added, and the sum of these two expenses is subtracted from the profit on sales to obtain the net profit.

NOTE: If this illustration is placed below the one in Exercise No. 206, you will have the complete process of ascertaining the net profit, including the facts necessary to obtain: (a) cost of the merchandise sold; (b) profit on sales; (c) expenses; and (d) net profit.

The following problems provide written practice in ascertaining the net profit resulting from the operation of a business. You will arrange your work on tablet paper as in the illustration.

1. The profit on the sales of merchandise by Coppin's Store during a certain year was $37,561.27. The selling expenses during the year were: clerks' salaries, $7,516.40; store supplies, $842.50; and advertising, $1,004.68. The general expenses during the year were: rent, $3,600; office salaries, $5,800; office supplies, $137.66. What was the net profit resulting from the operation of the business?

2. The profit made by selling merchandise by Clark & Sons Company during the current year was $9,621.50. The selling expenses during the year were: clerks' salaries, $2,250; store supplies, $152.50; advertising, $265.92. The general expenses during the year were: rent, $1,000; office salaries, $2,500; office supplies, $52.65. What was the amount of the net profit?

3. The profit made by selling merchandise during a year by the Adair Mercantile Company was $12,469.87. The selling expenses were: salaries of sales clerks, $4,621.82; store supplies, $419.74; advertising, $507.36. The general expenses during the year were: rent, $2,500; office salaries, $5,500; and office supplies, $213.66. What was the amount of net profit or net loss resulting from the operation of the business during the year?

4. The profit made by the Produce Exchange during the current year was $16,982.42. The expenses during the year were as follows: salaries of sales clerks, $5,171.50; store supplies, $367.53; advertising, $950; rent, $1,800; office salaries, $3,850; office supplies, $215.76. What was the net profit or net loss resulting from the operation of the business during the year?

5. The profit made by the Shoe Lumber Company through its operations during one year was $18,216.65. The expenses during the year were as follows: rent, $3,000; salaries of sales clerks, $6,250; advertising, $1,275.67; office supplies, $221.78;

store supplies, $563.48; office salaries, $5,200. Classify these items and ascertain the net profit or net loss resulting from the operation of the business.

6. The profit made by selling merchandise during a certain year by the Acme Photograph Company was, $6,281.88. The expenses were as follows: rent, $1,200; advertising, $350; salaries of clerks, $900; office salaries, $1,500; store supplies, $176.50; office supplies, $95.40. What was the net profit?

EXERCISE No. 212, RATE PER CENT OF PROFIT BASED ON SALES

A merchant usually uses the sales as the base for ascertaining the rate per cent of the various costs involved. If desired, the cost of the merchandise can be used, but since this is not known until the end of the business year, and the compensation of the salesmen is based on the sales, it is best to use the sales as the base.

The following problems provide written practice in: (a) ascertaining the per cent of profit on the sales when the costs are given; and (b) ascertaining what per cent each separate cost is of the sales. You are to show on tablet paper all calculations necessary to arrive at the desired facts.

	Sales	Cost of Sales	Selling Expenses	General Expenses
1.	$ 8,435.99	$ 4,281.35	$ 1,987.40	$ 1,546.82
2.	169,784.31	78,361.45	31,079.65	25,371.62
3.	48,378.53	26,164.75	9,163.57	7,145.29
4.	274,684.92	117,341.83	46,780.34	39,154.72
5.	8,884.65	3,452.75	1,583.32	1,480.56
6.	27,475.93	10,734.48	4,896.57	3,475.68
7.	834,751.28	217,375.82	98,108.41	91,473.28
8.	514,928.94	227,431.82	85,821.56	82,345.81

EXERCISE No. 213, ASCERTAINING THE SELLING PRICE

A merchant should know the cost of doing business. This cost includes rent, heat, light, sales clerks' salaries, delivery cost, advertising, etc. Knowing these costs, he can determine from the invoice cost of the merchandise the selling price in order to secure

a profit. The table on page 315 shows the required selling price when the cost of the article, cost of doing business, and desired per cent of profit are known; the cost of the article in the table is $1 but this may be applied to a cost which is greater or less. The illustration below shows the method of applying the table.

The invoice cost of gloves is $5.64 per dozen and the freight 12c per dozen. This means that the total cost of each pair of gloves is 48c. To ascertain the price at which these are to be sold to make the desired profit, it is necessary to multiply .48 by the amount in the space where the rate per cent of profit and the rate per cent of operating expense meet. Thus, if the cost of doing business is 23% of the net sales, and it is desired to make 25% profit on sales, multiply by 1.92; $.48 \times 1.92 = .9216 = 92$c, the retail price of the gloves.

The following problems provide written practice in ascertaining the sale price when the cost price, rate per cent of doing business, and rate per cent of desired profit are known. The first column contains the cost, the second, the rate per cent of doing business, and the third, the rate per cent of profit desired. You are to copy the problems and show the selling price in a fourth column. Use the table as a basis for ascertaining the selling price.

	1				2		
	Cost	Expenses	Profit		Cost	Expenses	Profit
a.	$0.89	21%	15%	*a.*	$3.50	20%	25%
b.	1.75	25%	20%	*b.*	3.50	25%	40%
c.	.39	19%	12%	*c.*	.20	25%	20%
d.	.15	25%	25%	*d.*	.785	23%	25%
e.	.16	23%	20%	*e.*	18.65	22%	20%
f.	.29	24%	30%	*f.*	.35	15%	15%
g.	124.35	25%	35%	*g.*	.4825	18%	25%
h.	.09	24%	40%	*h.*	416.75	25%	15%
i.	1.14	22%	20%	*i.*	.375	21%	20%
j.	.35	25%	25%	*j.*	2.1425	23%	25%
k.	.48	18%	9%	*k.*	.65	18%	6%
l.	1.40	21%	8%	*l.*	2.50	22%	9%
m.	.16	15%	15%	*m.*	.37	17%	12%
n.	1.25	16%	9%	*n.*	.99	16%	6%
o.	.85	15%	7%	*o.*	.88	19%	8%

A Table Showing Prices at Which You Must Sell an Article Costing $1.00 In Order to Make Any Desired Net Profit.

		1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	11%	12%	13%	14%	15%	20%	25%	30%	35%	40%	50%
15%	Cost of Doing Business																					
	Net Profit	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	11%	12%	13%	14%	15%	20%	25%	30%	35%	40%	50%
	Sell for	1.19	1.21	1.22	1.24	1.25	1.27	1.28	1.30	1.32	1.33	1.35	1.37	1.39	1.41	1.43	1.54	1.67	1.82	2.00	2.22	2.86
16%	Cost of Doing Business																					
	Net Profit	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	11%	12%	13%	14%	15%	20%	25%	30%	35%	40%	50%
	Sell for	1.21	1.22	1.24	1.25	1.27	1.28	1.30	1.32	1.33	1.35	1.37	1.39	1.41	1.43	1.45	1.56	1.70	1.85	2.04	2.27	2.94
17%	Cost of Doing Business																					
	Net Profit	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	11%	12%	13%	14%	15%	20%	25%	30%	35%	40%	50%
	Sell for	1.22	1.24	1.25	1.27	1.28	1.30	1.32	1.33	1.35	1.37	1.39	1.41	1.43	1.45	1.47	1.59	1.72	1.89	2.08	2.33	3.03
18%	Cost of Doing Business																					
	Net Profit	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	11%	12%	13%	14%	15%	20%	25%	30%	35%	40%	50%
	Sell for	1.24	1.25	1.27	1.28	1.30	1.32	1.33	1.35	1.37	1.39	1.41	1.43	1.45	1.47	1.49	1.61	1.75	1.92	2.13	2.38	3.13
19%	Cost of Doing Business																					
	Net Profit	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	11%	12%	13%	14%	15%	20%	25%	30%	35%	40%	50%
	Sell for	1.25	1.27	1.28	1.30	1.32	1.33	1.35	1.37	1.39	1.41	1.43	1.45	1.47	1.49	1.52	1.64	1.79	1.96	2.17	2.44	3.23
20%	Cost of Doing Business																					
	Net Profit	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	11%	12%	13%	14%	15%	20%	25%	30%	35%	40%	50%
	Sell for	1.27	1.28	1.30	1.32	1.33	1.35	1.37	1.39	1.41	1.43	1.45	1.47	1.49	1.52	1.54	1.67	1.82	2.00	2.22	2.50	3.33
21%	Cost of Doing Business																					
	Net Profit	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	11%	12%	13%	14%	15%	20%	25%	30%	35%	40%	50%
	Sell for	1.28	1.30	1.32	1.33	1.35	1.37	1.39	1.41	1.43	1.45	1.47	1.49	1.52	1.54	1.56	1.70	1.85	2.04	2.27	2.94	3.45
22%	Cost of Doing Business																					
	Net Profit	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	11%	12%	13%	14%	15%	20%	25%	30%	35%	40%	50%
	Sell for	1.30	1.32	1.33	1.35	1.37	1.39	1.41	1.43	1.45	1.47	1.49	1.52	1.54	1.56	1.59	1.72	1.89	2.08	2.33	3.03	3.57
23%	Cost of Doing Business																					
	Net Profit	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	11%	12%	13%	14%	15%	20%	25%	30%	35%	40%	50%
	Sell for	1.32	1.33	1.35	1.37	1.39	1.41	1.43	1.45	1.47	1.49	1.52	1.54	1.56	1.59	1.61	1.75	1.92	2.13	2.38	3.13	3.70
24%	Cost of Doing Business																					
	Net Profit	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	11%	12%	13%	14%	15%	20%	25%	30%	35%	40%	50%
	Sell for	1.33	1.35	1.37	1.39	1.41	1.43	1.45	1.47	1.49	1.52	1.54	1.56	1.59	1.61	1.64	1.79	1.96	2.17	2.44	3.23	3.85
25%	Cost of Doing Business																					
	Net Profit	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	11%	12%	13%	14%	15%	20%	25%	30%	35%	40%	50%
	Sell for	1.35	1.37	1.39	1.41	1.43	1.45	1.47	1.49	1.52	1.54	1.56	1.59	1.61	1.64	1.67	1.82	2.00	2.22	2.50	3.33	4.00

These figures are computed on a basis of SALES, from Butler Bros. Way System Book

BUTLER BROTHERS, New York, Chicago, St. Louis, Minneapolis, Dallas.

EXERCISE No. 214, MARKING GOODS

The invoice and transportation cost of each article should be determined at the time it is purchased and this marked on a tag attached to the article. With the cost price on a tag attached to an article, the sales clerk will be sure not to sell the article at less than cost, if he is given permission to vary the selling price, and the stock clerk can ascertain the cost value of each article when taking inventory.

Since the customer is interested only in the selling price, it is customary to indicate this in plain figures on the article and to show the cost price by a code which can be interpreted only by those familiar with its meaning. The customer has no interest in the cost price except through curiosity, and since he does not know the cost of doing business, he might think the variation between the cost and selling price was too great, if he knew both.

The illustration below shows the method of using the code word "pay-me-quick" with the letter "s" used as a repeater.

1	2	3	4	5	6	7	8	9	0
P	a	y	m	e	q	u	i	c	k

Cost....$7.19 Marking, upc
Cost.... 4.43 Marking, msy
Cost.... .99 Marking, cs

Referring to the application of this code word at the left, you will observe that the letters are substituted in place of figures, and "s" used as a repeater; this repeater is used only when two figures, which are the same, occur adjacent to each other as the two fours in 443.

Any word, or group of words, containing ten letters, no two or which are the same, can be used as a code word. Either the small letters or capitals may be used when marking the cost of an article.

The following code words are suggested for use in marking the cost price of merchandise; characters may be used, but code words are better.

1. Cornbasket
2. M. H. Lockyear
3. Victor Mead
4. Cedar Point
5. Alice Thumb
6. Paymequick

The following problems provide written practice in (a) ascertaining the selling price of goods, and (b) marking this selling price on the article. The six code words given above are to be used.

1. The Fair Store has six departments, cost and selling price are both marked on each article, but a different code word is used for each department. The table below shows one or more articles

in each department, with a description of each. You are to copy this table on tablet paper and insert the desired information in the columns that are blank. The last column at the right gives the number of the code word to be used. Use "x" as a repeater.

Kind of Goods	Unit	Cost	Code	Selling Price	Code	Code No.
a. Radium silk	yard	$ 1.25		$ 1.70		1
b. Men's shoes	pair	10.75		12.80		3
c. Men's hats	each	3.25		5.00		4
d. Armchairs	each	25.60		32.80		5
e. Men's suits	each	32.50		45.00		3
f. Ladies' hose	pair	1.45		2.25		6
g. Ladies' shoes	pair	8.30		10.40		6
h. Taffeta	yard	1.75		2.35		1
i. Satin	yard	2.50		2.89		1
j. Ladies' purses	each	5.40		8.25		2

2. The Peoples Grocery Company bought 150 bushels of potatoes at $1.75 per bushel; and paid $22.50 for freight, and $7.50 for drayage. It is desired to sell them at 20% profit with an additional 10% on selling price to provide for the selling expense. You are to show: (a) the cost price per bushel expressed by code word number 3; and (b) the selling price per bushel, expressed by the same code word.

3. Bought 40 dozen straw hats at $36.40 a dozen, less 10%, 5% and 2%. Paid freight $19.10. How shall we mark them, using key No. 2, to gain $33\frac{1}{3}\%$ on sales and allow 10% of sales for expense of selling?

4. Goods marked $\frac{\text{yek}}{\text{mua}}$ by key No. 6, are sold at what per cent of profit (a) on cost, if $12\frac{1}{2}\%$ of the sales is for selling expense? (b) On sales?

5. Using key No. 6, show the tag changed so that a gain of 20% will be realized on sales allowing 5% of sales for expense.

6. John Hammond bought 320 hammers, at $16.20 a dozen, less trade discounts of 5%, $2\frac{1}{2}\%$ and 1%; by paying cash he received a further discount of 2%. If the freight was $7.80 how shall he mark each hammer using key No. 1, so that he may sell at a profit of 5% on cost and allow 10 cents each for selling expense?

7. A ream of paper (500 sheets) costs $1.20. How many sheets can I sell for a nickel and gain 20% on sales, allowing 5% of sales for expense of selling?

8. Harry Ritter bought 5,000 cigars at $45 per M and received 250 cigars extra as a discount. (a) At what price must he sell them to make a profit of 20% on sales and allow 5% of sales for expenses? (b) Using key No. 4 show the marks he would place on a box containing 50 cigars. (c) How many can he afford to sell for 35c?

9. C. H. Douglas purchased 1,780 pounds of ham at 27c per pound. It was known by experience that the weight would be reduced 5% through shrinkage and the variation of weight in selling. At what price per pound must this ham be sold to gain 20% on sales and allow 10% of sales for selling expense?

10. The Novelty Shop bought one hundred dolls at $21.84 per dozen. Each was marked with Key No. 2 at a cost price of "meh", and a selling price of "hkr". When fifty-nine had been sold the selling price was increased so that the sale of the remainder would make good a loss because of one being broken. You are to show on tablet paper (a) the calculations necessary to arrive at the new selling price, and (b) the marking to show the new selling price using the same code.

EXERCISE No. 215, REVIEW PROBLEMS

1. The following five articles were sold at the prices mentioned with discounts of 10%, 10% and 10% on the total sales. Show on tablet paper all the calculations necessary to arrive at the net amount of the sale.

10	5¼″ 2-cell Fiber Case Flushes	$ .83 ea.
10	9 ″ 3-cell Fiber Case Flushes	2.25 ea.
1	gross Mazda Bulbs	1.00 doz.
⅙	doz. Double Cell Lanterns	2.90 ea.
5	Soldering Irons	2.75 ea.

2. What change was received from a $20 bill from the purchase of,

1	Electric Iron	$3.50 less 10%
1	Curling Iron	1.45 less 10%
1	Toaster	2.00 less 15%
1	Coffee Percolator	9.00 less 20%

3. An electric motor which cost \$60 was marked to sell at a profit of 40% on sales after deducting a trade discount of 20%. Show (a) the catalog price, and (b) the net selling price.

4. The invoice cost of a floor lamp was \$12.45 and the freight cost, 42c. (a) At what price should it be listed to make a profit of 45% on sales and allow a trade discount of 20% and 10%. (b) Show the cost and selling price marking, using code No. 3.

5. J. L. King purchased from The Electric Shop electric equipment invoiced to him at a list price of \$1,125 less 20%, 15%, and 5%, with an additional discount of 2% for cash. He paid \$200 cash and gave The Electric Shop his note due in 90 days without interest for an amount which when discounted at 8% would pay the net balance due. You are to show on tablet paper (a) all the calculations necessary to arrive at the net price of this equipment, and (b) the face of the note Mr. King gave The Electric Shop.

6. The Electric Shop has 12 lamps which cost \$18 each and are marked to sell at 25% above cost. Two were stolen. At what selling price must the remaining 10 be marked to make the same profit as it was intended to make on the sale of the 12?

7. Find the cost of the following merchandise less 10% and 5%:

3 30 x 3 Clincher Tires	\$ 5.80 ea.
4 30 x 3½ S. S. Oversize Tires	10.45 ea.
4 35 x 5 S. S. Oversize Tires	23.85 ea.
1 gross Quick Repair Rim Hooks	.60 doz.

8. Robert Anderson, a dealer, purchased from the Johnson Paint Company the following paint:

6 pts. Black	x185	\$0.80	20 qts. Brown	x190	\$1.65
6 qts. Black	x186	1.35	6 pts. Gray	x191	.90
12 pts. Blue	x187	.90	6 qts. Gray	x192	1.65
12 qts. Blue	x188	1.65	9 pts. Green	x193	.90
18 pts. Brown	x189	.90	12 qts. Green	x194	1.65

This paint was billed at the prices mentioned less a trade discount of 25%. Ascertain the net cost to Mr. Anderson.

9. What would be Mr. Anderson's list prices and selling prices of (a) the Blue quarts, and (b) the Blue pints in order to make a profit of 20% on sales if the cost of doing business is 21% and a trade discount of 15% and 10% is allowed?

10. The Evans Hardware Company sold the following merchandise to Robert Haniford:

12 ½ pt. Golden Star polish @	35c ea.
6 pts. Golden Star polish @	65c ea.
12 cans Reflector polish @	25c ea.
10 large sponges @	$1.25 ea.
10 5# hand cleaner @	2.00 ea.

You are to ascertain the net cost to Mr. Haniford if a trade discount of 5% and 5% was allowed from the prices given.

11. The Pickering Hardware Company sold James Mason the following hardware:

2 sets socket wrenches	$10.00 ea.
10 No. 5 wrenches	.65 ea.
10 T225 Pistol Grip necksaw	1.65 ea.
12 T310 Ex. Heavy pliers	1.40 ea.
25 ½″ diam. 5″ cold chisels	.30 ea.

What was the cost to Mr. Mason, less discounts of 25% and 15%?

12. The Peoples Radio Company sold W. O. Crosswhite the following radio supplies:

6 Potentiometers 400 ohm, $1.25 ea. less 30%
3 Rheostats 30 ohm, 75c ea. less 33⅓%
3 Rheostats 50 ohm, 80c ea. less 33⅓%
100 ft. hookup wire, 1c per ft. net
5 Master dials ¼ in. shaft, 75c ea. less 30%
1 3 plate condenser, $2.50 less 30%
1 11 plate condenser, $3 less 30%
1 Master 23 plate Var. condenser, $6 less 30%

How much did Mr. Crosswhite pay for this material?

13. The Wurlitzer Radio Company sold J. F. Sherwood the following bill of radio supplies:

2 Arkoy vernier adjust., 75c ea. less 33⅓%
600 ft. aerial wire at $1.25 per C ft. less 30%
2 ¼# spools #18 silk cov. wire, 30c ea. less 30%
1 ½# spool #20 silk cov. wire, 60c less 30%
1 ½# spool #22 silk cov. wire, 70c less 30%
2 ¼# spools #24 silk cov. wire, 48c ea. less 30%
1 ¼# spool #26 silk cov. wire, 56c less 30%

How much did Mr. Sherwood pay for this material?

14. What should be the list price of an article which cost $127.50 with freight and drayage charges of $3.82, if it costs 23% to do business, and it is desired to make a profit of 21%, and allow trade discounts of 10%, 10%, 5%, and 5%?

15. The Willis Restaurant Company purchased a Frigidaire for $975, less 2% for cash. Mr. Willis, the manager, paid $400 cash, and gave a 60-day note for an amount which when discounted at the bank at 8% would pay the balance due. What was (a) the face of the note, (b) the discount on the note?

16. The Jenkins Dry Goods Company received by parcel post, 1 dozen pairs of silk hose, invoice cost, $26, plus postage, 55c. What would be the retail price if the cost of doing business is 22% and the desired profit is 19%?

17. Verify the following inventory of radio supplies in stock by the H. J. Remlin Radio Company, December 31, and show the correct total:

a. ADAPTORS, TUBE				
7 Connecticut	$ .75	$ 5.25		
6 Arrow	.90	5.40	$10.65	
Less 35%			3.73	$6.82
b. BRIGHT STAR B BATTERIES				
2 No. 15-50, 22½, small	$1.50	$3.00		
3 No. 15-91, 22½, upright	1.75	4.25	8.25	
Less 50%			4.13	4.12
c. LONG LIFE BRAND B BATTERIES				
2 22½-Volt, medium	$2.00	$4.00		
1 45 -Volt, large	5.00	5.00	$9.00	
Less 50%			4.50	$4.50
d. BATTERY CHARGERS				
2 Fore Rectifier	$18.50	$37.00		
3 Sterling Silent	22.50	67.50	$104.50	
Less 35%			34.58	67.92
e. BATTERY CLIPS				
400 Large, per 100	$4.50	$18.00		
7 Dixie	.25	1.75	$19.75	
Less 40%			7.90	11.85
f. MARKED BINDING POSTS				
17 Complete sets	$ .50	$8.50		
Less 45%			3.83	4.57

g. K. D. Oak Cabinets

3 7 x 10	$1.50	$4.50		
2 7 x 14	2.00	4.00		
1 7 x 18	2.25	2.25		
4 7 x 21	2.60	10.40		
1 7 x 24	3.00	3.00	$24.15	
Less 35%			8.35	15.70

h. Complete Sets

2 Freshman Masterpiece	$60.00	$120.00		
1 Michigan Midget	27.00	27.00		
3 Michigan Amplifier	30.00	90.00		
2 Ambassador	60.00	120.00	$347.00	
Less 35%			124.95	232.05

i. Variable Condensers

3 56X	$5.00	$15.00		
5 56D	5.50	27.50		
6 57X	7.50	45.00		
2 57F	8.50	17.00		
1 58A	5.50	5.50		
2 59D	8.50	17.00		
3 51X	6.00	18.00		
5 52F	9.50	47.50	$192.50	
Less 35%			67.38	124.14

j. Grebe Receiving Sets

1 CR-5	$80.00	$80.00		
3 RORK	55.00	165.00		
1 CR-8	80.00	80.00		
2 RORD	75.00	150.00		
1 CR-3	65.00	55.00		
1 CR-14	110.00	110.00		
2 CR-12	175.00	350.00	$1,000.00	
Less 45%			450.00	550.00

k. Grid Leak Mountings

17 Grid Leak Holders	$ .25	$4.25		
15 Freshman Fixo	.65	8.75	$13.00	
Less 40%			5.20	7.80

l. Grid Leak Stationary

36 Gem	$ .30	$10.80		
45 Royalty	.50	22.50	33.30	
Less 35%			11.66	21.54

m. MOUNTED HONEYCOMB COILS

15	25 turns	$1.40	$21.00	
12	50 turns	1.50	18.00	
14	100 turns	1.70	23.80	
8	200 turns	1.80	14.40	$77.20
	Less 40%			30.88 46.32

n. HYDROMETERS

4	Never-Fail	$1.00	$4.00	
3	Large Test Rite	1.00	3.00	
5	Scranton	1.00	5.00	$12.00
	Less 40%			4.80 7.30

o. INSULATORS

10	Barrel Type, per 100	$8.00	$ .80	
6	Porcelain cleats, per 100	3.50	.21	1.01
	Less 33⅓%			.34 .67

p. MAGNET WIRE

50	No. 18	$ .24	$12.00	
40	No. 20	.26	10.40	
35	No. 22	.32	11.20	
20	No. 24	.36	7.20	
15	No. 26	.46	6.90	
15	No. 28	.58	8.70	56.40
	Less 33⅓%			18.80 37.60

q. PHONOGRAPH ATTACHMENTS

4	American	$ 5.00	$20.00	
2	Western Electric	12.00	24.00	
1	Thorola	15.00	15.00	59.00
	Less 35%			20.65 38.45

r. POTENTIOMETERS

7	Radio Corp.	$1.25	$8.75	
5	AMSCO	1.75	8.75	
3	General Inst. Co.	1.75	5.35	22.75
	Less 35%			7.96 14.79

s. RHEOSTATS

7	De Forest, 6 ohm	$ .55	$3.85	
5	Kellogg, 6 ohm	1.50	7.60	
6	Kellogg, 30 ohm	1.50	9.00	$20.35
	Less 33⅓%			6.78 13.57

t. SOCKETS

121	C-299-UV-199 type	$ .75	$90.75	
132	Burke 199	.75	99.00	
216	Waterbury 199	.75	162.00	
309	S. D. 11 Types	.18	55.62	
37	Standard	.75	27.75	
24	Kellogg	.75	18.00	
119	Waterbury	.50	59.50	
39	Standard	.60	23.40	
64	General Radio	1.00	64.00	
7	Federal	1.00	7.00	
18	Rashop	.40	7.20	$624.24	
	Less 40%			245.69	368.53

u. LOUD SPEAKERS

2	Thorola No. 4	$25.00	$50.00	
1	Thorola No. 3	20.00	20.00	
3	Thorola No. 6	15.00	45.00	$115.00	
	Less 35%			40.25	76.75

v. TRANSFORMERS

9	Apex, ratio 5-1, 1st stage	$2.20	$19.80	
12	Apex, ratio 3-1, 2d stage	2.25	27.00	
14	Acme, ratio 3½ to 1	5.00	70.00	
13	Amertran, ratio 5-1	7.00	91.00	
8	Erla, 3½-1, first stage	4.00	32.00	
4	Erla, 6-1, second stage	4.50	18.00	
7	Kellogg, 3-1, first stage	4.50	31.50	
2	Kellogg, 4½-1, second stage	4.50	9.00	
1	Acme, R-2	5.00	5.00	
6	Acme, R-3-1 Stage Radio	5.00	30.00	
3	Acme-R-4-3 Stage Radio	5.00	15.00	
6	Radio Ins. Co	7.50	45.00	
2	Erla for reflex work	5.00	10.00	
8	Erla No. 1 Reflex	5.00	40.00	
1	Erla No. 2 Reflex	5.00	5.00	$448.30	
	Less 40%			179.32	268.98

w. VARIOCOUPLERS

3	Shamrock	$3.50	$10.50	
2	Apex	3.50	7.00	
9	Hilco	7.00	63.00	
8	Hartman	6.50	52.00	
1	Pioneer	7.00	7.00	
9	Gem Radio	3.50	31.50	
6	Oscillator	3.00	18.00	$189.00	
	Less 40%			75.60	$114.40
	Total				$1,808.05

CHAPTER XXV

PROBLEMS OF A MANUFACTURER

A manufacturer buys raw material and through the manufacturing process changes this in form to meet the requirement of his customers. The cost of the merchandise he manufactures includes (a) the raw material, (b) the transportation cost on raw material, (c) the labor required to manufacture, and (d) the manufacturing expenses, such as rent, heat, light, superintendent's salary, foreman's salary, etc.

EXERCISE No. 216, COST OF GOODS MANUFACTURED

A manufacturer records the value of raw material in stock at the beginning of the year, raw material purchased during the year, freight on this raw material, wages paid employees, and amounts paid for advertising expense. From these records and the inventory at the end of the year it is possible to ascertain the cost of the goods manufactured.

The records of the Bryant Manufacturing Company show the following facts: raw material on hand at the beginning of the year, $8,261.50; raw material purchased during the year, $9,965.60; freight on raw material, $865.55; labor, $6,542.90, manufacturing expense, $4,407.60; raw material on hand at the end of the year, $7,986.42. The method of arriving at the cost of the goods manufactured with these facts is shown in the illustration below.

Beginning Inventory of Raw Material		$ 8,261.50
Purchases of Raw Material	$9,965.60	
Freight on Raw Material	865.55	10,831.15
Total Raw Material Purchased		19,092.65
Less Ending Inventory of Raw Material		7,986.42
Cost of Raw Material in Goods Manufactured		11,106.23
Labor	6,542.90	
Manufacturing Expense	4,407.60	10,950.50
Total Cost of Goods Manufactured		22,056.73

The cost of the raw material on hand at the beginning of the year, plus the cost of the raw material purchased during the year, plus the freight,

gives the total cost of raw material to be accounted for. Deducting the value of the raw material in stock at the end of the year, gives the amount of raw material used in the goods manufactured. Adding to this, the labor cost and the manufacturing expense, gives the total cost of manufactured goods.

The following problems provide written practice in ascertaining the cost of goods manufactured when the necessary facts are available. You will show on tablet paper the solution of each problem arranged as in the illustration.

1. Beginning inventory, $8,729.65; purchases, $12,500.00; freight on purchases, $1,162.41; ending inventory, $4,861.55; labor, $8,123.40; manufacturing expense, $3,641.82.

2. Beginning inventory, $9,779.32; purchases, $13,641.50; freight on purchases, $892.99; ending inventory, $6,267.68; labor, $9,175.55; manufacturing expense, $6,237.80.

3. Beginning inventory, $9,465.50; ending inventory, $7,622.50; purchases, $15,582.50; freight, $2,004.17; labor, $11,621.92; manufacturing expense, $9,471.75.

4. Beginning inventory, $10,999.87; ending inventory, $8,642.55; purchases, $16,687.96; freight, $762.55; labor, $5,421.75; manufacturing expense, $1,232.52.

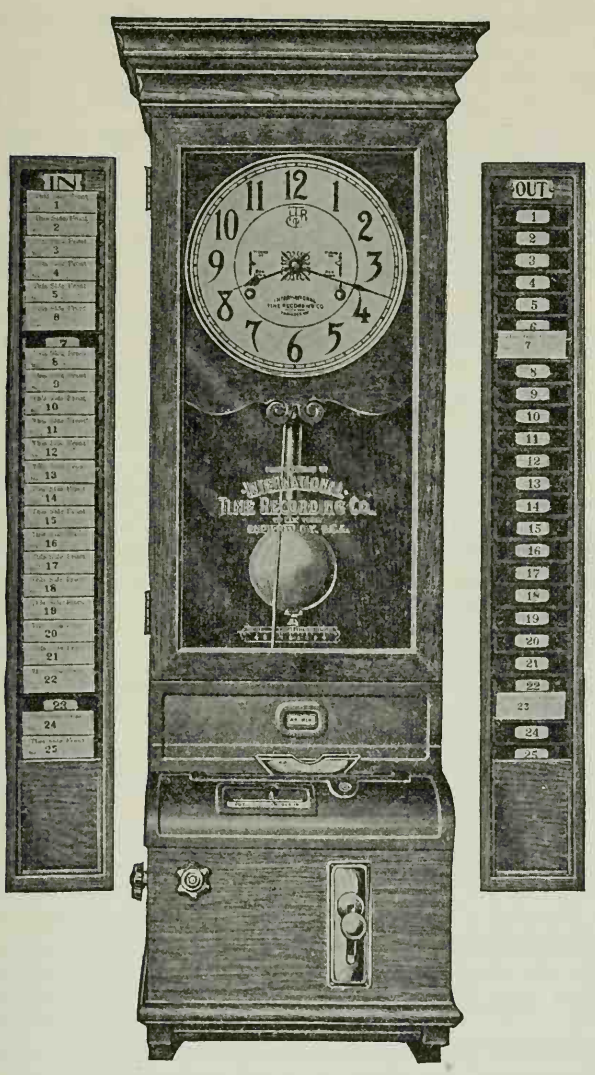
5. Freight, $4,281.17; purchases, $22,694.98; beginning inventory, $7,655.55; ending inventory, $10,217.62; labor, $12,552.48; manufacturing expense, $7,216.66.

NOTE: The manufacturer makes a profit by selling the merchandise he produces at a greater price than it costs to manufacture. The amount added to the cost to ascertain the selling price must be sufficient to cover (a) the cost of selling; (b) the cost of maintaining the office, and (c) the manufacturer's profit. The manufacturer produces the merchandise offered for sale through the operations of his factory; the merchant buys the merchandise offered for sale.

EXERCISE No. 217, LABOR COST

One of the chief problems of the manufacturer is to ascertain the labor cost in the merchandise manufactured. To facilitate the calculations, it is customary to require each employee to keep a record of his own time through the use of a time clock. The illustration on page 327 shows a time clock, and on page 328, the record of an employee's time as a result of registering

(*Continued on page 328*)



TIME CLOCK

Each employee is provided with a number and with a card on which to keep a record of his time for each week. This record is made on the time clock which records the time automatically when the card is placed in the clock. The rack at the left contains the cards while the employees are at work, and the rack at the right contains these same cards when the employees are not at work.

(*Exercise No. 217—Continued from page 326*)

his time on the card through the use of the time clock. With the number of hours worked by the employee available, the time clerk can ascertain the amount due the employee by multiplying the number of hours by the wage per hour.

No. 24

Albert Barnes

WEEK ENDING. April 10, 1926

DAY	MORNING		AFTERNOON		OVERTIME		
	IN	OUT	IN	OUT	IN	OUT	
SUN							
MON.	7:30	12:02	12:50	5:03			8½
TUE			12:55	5:01			4
WED	7:25	12:05	12:54	5:01			8½
THU.	9:15	12:01	12:50	5:04			6¾
FRI	7:28	12:00	12:59	5:05	5:30	7:36	11½
SAT	7:29	1:05					5½

TOTAL TIME 44¾ HRS.

RATE .60

TOTAL WAGES FOR WEEK $ 26.85

Each employee is given a time card which contains his name and number, the date and space for his time during each day of the week. In the illustration, Albert Barnes, employee No. 24, has worked full time on Monday because he registered before beginning time in the morning (7:30), after quitting time at noon (12:00), before beginning time for the afternoon (1:00), and after quitting time in the afternoon (5:00). Tuesday, Mr. Barnes did not work in the forenoon, hence will receive pay for only 4 hours. Wednesday, he worked full time. Thursday, he was one and three fourths hours late, hence worked only $6\frac{3}{4}$ hours. On Friday, he worked two hours over time which entitles him to three hours' pay, hence $11\frac{1}{2}$ hours on this day. Saturday, he worked the usual time, that is, from 7:30 until 1:00, or $5\frac{1}{2}$ hours.

The total number of hours worked during the week was $44\frac{3}{4}$. The rate per hour is 60c, hence Mr. Barnes will receive $.60 \times 44\frac{3}{4}$ or $26.85. Sometimes the information on the card is transferred to a sheet similar to that shown in connection with problem 5 on page 330 and the information regarding the amount due is recorded on this sheet instead of the card. In other words, the pay roll may be made up direct from the information recorded on the cards or this same information transferred to a pay roll sheet.

The following problems provide written practice in ascertaining the time from the time cards on page 329 and the amount due each. The daily time applicable to each of the four time cards shown in problems 1–4 on page 329 is 7:30 A. M. to 12 M., 12:30 P. M. to 4:30 P. M. for the first five days, and 7:30 A. M. to 1:00 P. M. Saturday. Any time worked before or after these hours is overtime which is paid for at an agreed rate of time and a half; this means that the employee who works 1 hour overtime

gets pay for $1\frac{1}{2}$ hours. You are to ascertain for each time ticket (a) the total regular time and overtime for the week, and (b) the amount of the employees wages for the week at the rate given.

No. 1

L. B. Smith

WEEK ENDING, May 15, 1926

DAY	MORNING		AFTERNOON		OVERTIME	
	IN	OUT	IN	OUT	IN	OUT
FRI.	7:28	12:01	12:29	4:32		
SAT.	7:01			1:03		
SUN.						
MON	7:27	12:01	12:28	4:32		
TUE	7:29	12:02	12:29	4:31		
WED.			12:28	4:30	4:31	7:00
THU	7:28	12:01	12:29	4:31		

TOTAL TIME _____ HRS.

RATE .65

TOTAL WAGES FOR WEEK $ _____

No. 2

Frank Day

WEEK ENDING, May 15, 1926

DAY	MORNING		AFTERNOON		OVERTIME	
	IN	OUT	IN	OUT	IN	OUT
FRI.	7:29	12:02	12:29	4:31		
SAT	8:00			1:01		
SUN.						
MON	7:29	12:03	12:29	4:32		
TUE	6:30	12:01	12:28	4:31		
WED.	7:28	12:01				
THU.			12:29	4:30	4:31	6:30

TOTAL TIME _____ HRS.

RATE $1.00

TOTAL WAGES FOR WEEK $ _____

No. 3

George Martin

WEEK ENDING, May 15, 1926

DAY	MORNING		AFTERNOON		OVERTIME	
	IN	OUT	IN	OUT	IN	OUT
FRI	7:28	12:01	12:29	4:31		
SAT	7:29			1:02		
SUN						
MON			12:29	4:30	4:31	6:30
TUE	7:29	12:02	12:28	4:32		
WED	7:29	12:01	12:29	4:31		
THU	7:28	12:01	12:28	4:30	4:31	7:30

TOTAL TIME _____ HRS.

RATE $1.25

TOTAL WAGES FOR WEEK $ _____

No. 4

J. D. Kline

WEEK ENDING, May 15, 1926

DAY	MORNING		AFTERNOON		OVERTIME	
	IN	OUT	IN	OUT	IN	OUT
FRI	9:00	12:02	12:29	4:30	4:31	6:00
SAT	7:29			1:02		
SUN.						
MON.			12:29	4:30	4:31	6:30
TUE	7:28	12:01	12:29	4:31		
WED.	6:30	12:02	12:29	4:32		
THU	7:29	12:01	12:28	4:31		

TOTAL TIME _____ HRS.

RATE .95

TOTAL WAGES FOR WEEK $ _____

5. PAY ROLL AND MEMORANDUM

No.	NAME	HOURS PER DAY						TOTAL HOURS	WAGES PER HOUR	TOTAL WAGES		BILL AND SPECIAL MEMORANDUM								
		M	T	W	T	F	S					$10	$5	$2	$1	50c	25c	10c	5c	1c
1	L. Scott	8	8	8	8	8	4	44	.95	41	80	4			1	1	1		1	
2	T. Buchanan	8	8	8	8	8	5	45½	.89	40	50	4				1				
3	R. B. Brown	8	4	7½	8	6	4	38½	.81	30	38	3					1	1		3
4	E. B. Wickman	7	8	8	7	8	4	42	.86	36	22	3	1		2			1		2
5	R. Curry	8	7	4	8	6½	4	37½	.87	32	63	3		1		1		1		3
6	J. W. O'Dell	8	8	7	7	8	4	42	.85	35	70	3	1			1		2		
7	B. L. Hughes	4	8	8	8	7	4	39	.90	35	10	3	1					1		
8	H. P. Roberts	8	8	8	8	8	4	44	.92	40	48	4					1	2		3
9	P. G. Hudson	8	8	8	8	8	4	44	.83⅓	36	57	3	1		1	1		1	1	2
10	J. Bridges	8	8	7	8	8	4	43	.90	38	70	3	1	1	1	1		2		
11	A. Hickling	8	8	6	7	7	4	40	.91	36	40	3	1		1		1	2	1	
12	Mack Hind	8	7	8	6	8	4	42	.87½	35	88	3	1			1	1	1		3
13	T. Romano	8	8	8	8	7	5½	45½	.89	40	27	4					1			2
14	T. W. Quandt	8	5½	8	7	7½	4	40	.91	36	45	3	1		1		1	1	1	
								Totals												

This pay roll sheet was made up from daily time cards similar to those in the preceding exercise. Full time is 8 hours each day the first five days and 4 hours on Saturday. Time and one half is allowed for overtime. You are to verify (a) the amount, (b) the change required to pay each employee and (c) ascertain the total pay roll. The method of ascertaining the correct change was explained and illustrated in Exercise No. 25.

6. The data given in the following pay roll applies to piece work. Each employee receives 37c per unit or piece which he or she completes. The amount due each employee is ascertained by adding the number of units he has completed during the 6 days and multiplying the sum by the price per unit. When a different price is paid for different units, it is necessary to have

columns in which to record the number of units applicable to each price.

No.	Name	M.	T.	W.	Th.	F.	S.
136	A. L. Day	9	11	14	12	10	5
137	C. H. Gay	8	9	11	13	11	5
138	R. H. Joy	10	11	13	14	12	5
139	O. B. Good	11	10	12	14	10	7
140	Geo. Mays	12	12	12	10	11	5
141	John Martin	11	11	11	11	11	5
142	Caleb Powers	12	11	13	12	10	5
143	R. H. Aul	12	11	13	12	10	5

Copy the above pay roll on a pay roll sheet similar to that in problem 5, this exercise, and ascertain, (a) the amount due each employee for the number of pieces completed during the week, (b) the total amount due the employees, (c) the change necessary to pay each employee, and (d) show proof of the change.

7. Weekly Pay Roll Sheet

No.	Name	M.	T.	W.	Th.	F.	S.	Rate
1	Alice Stone	$8\frac{1}{2}$	9	9	$9\frac{1}{2}$	$8\frac{1}{2}$	$5\frac{1}{2}$	\$0.42½
2	Alice Bateman	$9\frac{3}{4}$	9	8	..	..	..	.37½
3	Martha Wright	9	$9\frac{1}{2}$	8	8	$8\frac{1}{2}$	$5\frac{1}{2}$	.40
4	Nora Kirk	9	$8\frac{1}{2}$	7	8	7	$5\frac{1}{2}$	.28
5	Etta Brown	9	10	9	..	9	$5\frac{1}{2}$	.33⅓
6	Lucy Maurer	7	7	7	7	7	7	.40
7	Mabel Davis	$8\frac{1}{2}$	$8\frac{1}{2}$	$8\frac{1}{2}$	$8\frac{1}{2}$	$8\frac{1}{2}$	$5\frac{1}{2}$	.50
8	Alice Pringle	$8\frac{1}{2}$	$8\frac{1}{2}$	$8\frac{1}{2}$	$8\frac{1}{2}$	$8\frac{1}{2}$	$5\frac{1}{2}$	.50
9	Hazel Howard	$7\frac{1}{4}$	$8\frac{1}{2}$	$8\frac{1}{2}$	$8\frac{1}{2}$	$8\frac{1}{2}$	..	.46⅔
10	Viva Baker	$8\frac{1}{2}$	..	$3\frac{1}{2}$	$8\frac{1}{2}$	$8\frac{1}{2}$	$5\frac{1}{2}$	.50
11	Mary Wheaton	$8\frac{1}{2}$	$8\frac{1}{2}$	9	$8\frac{1}{2}$	$8\frac{1}{2}$	$5\frac{1}{2}$	.45
12	Rose Lee	$8\frac{1}{2}$	$8\frac{1}{2}$	9	$8\frac{1}{2}$	$7\frac{1}{2}$	$5\frac{1}{2}$	.48

The regular time is 48 hours per week, $8\frac{1}{2}$ hours each of the first five days of the week, and $5\frac{1}{2}$ hours on Saturday. Time in excess of the regular time each day is overtime to be paid on a basis of time and one half. Find (a) the amount due each employee, (b) the total amount of the pay roll, and (c) the change necessary to pay each employee.

8. Weekly Pay Roll Sheet

No.	Name	M.	T.	W.	Th.	F.	S.	Rate
1	Roland Ward	8	9	9	10½	9¼	5	$0.94
2	Dick Rowan	9¾	9½	8	8	9½	5	.52
3	Ben Putnam	8	8	..	9½	8	5	.45
4	Thos. Morgan	9	9	8	10	10	5	.47½
5	T. E. Castle	8	8	9	8	9	5	.50
6	W. R. Allen	10	8½	8	10	..	..	.55
7	Roy De Sort	9¼	9¼	8	9	9¾	6	.48
8	Pat Hagan	..	..	..	9½	8	5	.43⅓
9	Chas. Titch	9	9	9	½	10	5	.43⅓
10	G. E. Davis	9	8	10	9	8	5	.66
11	T. M. Lee	8	9¼	9	8	9¼	7	.60

The regular working time is 45 hours per week, 8 hours each of the first five days of the week, and 5 hours on Saturday. Time in excess of the regular time each day is overtime to be paid on a basis of time and one half. Find (a) the amount due each employee, (b) the total amount of the pay roll, and (c) the change necessary to pay each employee.

9. The following shows the time and wage of 14 employees of the Day Manufacturing Company. You are to ascertain (a) the amount due each employee (b) the total of the weekly pay roll and (c) the change required to pay each employee.

No.	Name	M	T	W	T	F	S	Rate	No.	Name	M	T	W	T	F	S	Rate
1		8	8	8	4½	8	5	$0.54½	8		7¾	7½	8	8	8	5	$0.57½
2		8	7¾	8½	7¼	7¾	5	.57⅔	9		8	8	..	..	7½	5	.53¼
3		5¾	8	8	8	8	5	.57½	10		8¼	8	8	..	4¼	5	.47½
4		8	8	7¼	..	..	5	.46¾	11		8	8	8	8	8	5	.53⅓
5		..	8	8	8¼	8½	5	.48	12		8	8	8	8	8	5	.48¼
6		8	8⅓	7½	8½	8	5	.52½	13		8	7½	8	8	8	5	.57½
7		8¼	8	8¼	8½	8	5	.56	14		7¾	7¼	8¼	8	7¾	5	.57½

10. The Davis Contracting Company has 12 employees with hourly wages as follows:

No.	Name	Hourly Wage
1	A. L. Jones	95c
2	Frank Baker	95c

No.	Name	Hourly Wage
3	George Craft	95c
4	Harry Ritter	82c
5	Albert Brooks	82c
6	W. C. Luckey	82c
7	James Johnson	75c
8	C. A. Norman	75c
9	J. M. Farris	75c
10	C. B. Crawford	67c
11	James Walker	67c
12	George Bailey	67c

The number of hours worked by each employee during the week ending May 12 was as follows:

Monday: No. 1, $8\frac{1}{2}$ hours; No. 2, 8 hours; No. 3, $8\frac{1}{2}$ hours; No. 4, $8\frac{1}{2}$ hours; No. 5, 7 hours; No. 6, 8 hours; No. 7, 7 hours; No. 8, $8\frac{1}{2}$ hours; No. 9, 8 hours; No. 10, $8\frac{1}{2}$ hours; No. 11, 8 hours; No. 12, $8\frac{1}{2}$ hours.

Tuesday: No. 1, 8 hours; No. 2, $8\frac{1}{2}$ hours; No. 3, 7 hours; No. 4, $8\frac{1}{2}$ hours; No. 5, 8 hours; No. 6, 7 hours; No. 7, 8 hours; No. 8, 8 hours; No. 9, 7 hours; No. 10, $8\frac{1}{2}$ hours; No. 11, 7 hours; No. 12, 8 hours.

Wednesday: No. 1, 8 hours; No. 2, $8\frac{1}{2}$ hours; No. 3, $8\frac{1}{2}$ hours; No. 4, 7 hours; No. 5, $8\frac{1}{2}$ hours; No. 6, $8\frac{1}{2}$ hours; No. 7, $8\frac{1}{2}$ hours; No. 8, $8\frac{1}{2}$ hours; No. 9, 8 hours; No. 10, 8 hours; No. 11, 8 hours; No. 12, 7 hours.

Thursday: No. 1, $8\frac{1}{2}$ hours; No. 2, $8\frac{1}{2}$ hours; No. 3, $8\frac{1}{2}$ hours; No. 4, 8 hours; No. 5, 7 hours; No. 6, 8 hours; No. 7, 8 hours; No. 8, 8 hours; No. 9, $8\frac{1}{2}$ hours; No. 10, 8 hours; No. 11, $8\frac{1}{2}$ hours; No. 12, $8\frac{1}{2}$ hours.

Friday: No. 1, 8 hours; No. 2, $8\frac{1}{2}$ hours; No. 3, 7 hours; No. 4, $8\frac{1}{2}$ hours; No. 5, $8\frac{1}{2}$ hours; No. 6, $8\frac{1}{2}$ hours; No. 7, $8\frac{1}{2}$ hours; No. 8, 8 hours; No. 9, 8 hours; No. 10, $8\frac{1}{2}$ hours; No. 11, $8\frac{1}{2}$ hours; No. 12, $8\frac{1}{2}$ hours.

Saturday: No. 1, 5 hours; No. 2, $5\frac{1}{2}$ hours; No. 3, $4\frac{1}{2}$ hours; No. 4, 5 hours; No. 5, $5\frac{1}{2}$ hours; No. 6, $5\frac{1}{2}$ hours; No. 7, 5 hours; No. 8, $5\frac{1}{2}$ hours; No. 9, $5\frac{1}{2}$ hours; No. 10, 5 hours; No. 11, 5 hours; No. 12, 5 hours.

You are to ascertain in your own way, (a) the amount due each employee and (b) the change necessary to pay him.

11. The Jones Manufacturing Company operates on a piece basis with a differential rate. The rate is based on a standard number of pieces per day with a greater price for over production, and a less price for under production. The work produced by six of the employees doing one specific kind of work during the week ending July 17, is given in the illustration below. You are to show on tablet paper all of the calculations necessary to find the amount due each employee in accordance with the differential rate. Show proof of the correctness of your results.

NAME	M.	T.	W.	Th.	F.	S.
Mary Brown	37	36	35	40	32	33
Sadie Brewer	42	45	39	36	40	40
Mabel Homer	42	42	41	40	39	40
Jessie Clark	41	41	39	37	..	36
Bessie Davis	42	42	42	40	39	41
Ruth Haynes	41	42	40	41	42	39
Flora Bennett	39	40	42	41	38	37
Lucy Wright	41	43	40	38	39	40
Laura Clark	38	39	41	37	40	38

The price per piece is 14c based on a standard of 40 pieces per day with a variation of $\frac{1}{4}$c for each piece above or below the standard. This means that an employee who completes 45 pieces will receive 15$\frac{1}{4}$c for each of them, while an employee who completes only 38 pieces would receive only 13$\frac{1}{2}$c for each.

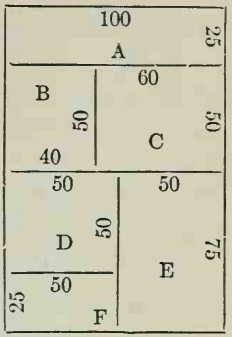
EXERCISE No. 218, DISTRIBUTION OF RENT

Manufacturing expense includes, (a) rent, (b) taxes, (c) insurance, (d) depreciation, (e) superintendent's salary, (f) foreman's salary, (g) heat, (h) light, (i) power, and (j) special services furnished employees such as soap, water, towels, etc. Manufacturing expense is distributed over the cost of the goods manufactured by the various departments, or *factors*, as they are sometimes termed in the factory.

The rent cost is usually distributed over each department on a basis of floor space occupied by the department. Thus, if a factory has five departments and each occupies the same floor space, the rent will be divided equally among them, but if one department occupies more floor space than another, this will be charged with a greater part of the rent.

The illustration at the right shows a diagram of a factory with six departments and the floor space occupied by each department. At the left of this is shown the method of distributing the monthly rent of $300.

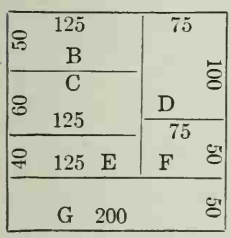
Dept. A	2,500 sq. ft. = $\frac{1}{6}$ =	$ 50.00
Dept. B	2,000 sq. ft. = $\frac{2}{15}$ =	40.00
Dept. C	3,000 sq. ft. = $\frac{1}{5}$ =	60.00
Dept. D	2,500 sq. ft. = $\frac{1}{6}$ =	50.00
Dept. E	3,750 sq. ft. = $\frac{1}{4}$ =	75.00
Dept. F	1,250 sq. ft. = $\frac{1}{12}$ =	25.00
	15,000 sq. ft. = $\frac{60}{60}$ =	$300.00



Since the factory occupies 15,000 square feet, the part of the $300 charged against any department will be the result obtained by multiplying $300 by a fraction with the total square feet in the factory as a denominator, and the number of square feet in the department as the numerator. When the rent is paid, each department is charged with the amount in the right hand column on a line with it. This insures the rent cost being included in the costs applicable to operating the department, and being used as a basis for arriving at the net profit resulting from the operation of the department.

The following problems provide written practice in distributing rent. You will draw a diagram of each building on tablet paper, insert the departments as in the illustration above, place the schedule of distribution at the left as in the illustration. Show in connection with this all the calculations necessary to distribute the rent.

1. The Thompson Manufacturing Company occupies two floors of a building 200 ft. by 200 ft., inside measurements. The operations are grouped in seven departments. Department A occupies the entire first floor. The second floor contains the other six departments. The space for each is shown in the diagram at the left. The annual rent is $12,000 per year. You are to ascertain the amount of the monthly rent to be charged against each department.



2. The Davidson Garage occupies one floor of a building 75 ft. by 195 ft. for which it pays an annual rent of $9,000. The concern maintains four departments, (a) storage, (b) repairs, (c) paint shop, and (d) used car stock. The storage department oc-

cupies 50 ft. by 100 ft.; the repair shop, 95 ft. by 45 ft.; the paint shop, 25 ft. by 100 ft.; used car department, 30 ft. by 95 ft. You are to show on tablet paper the amount of the monthly rent to be charged to each department and the method of distribution.

3. The Newman Printing Company occupies the entire fourth floor of a building with 7,000 sq. ft., for which they pay an annual rent of $4,800. It is desired to show the proper distribution of the monthly rent over the following departments: Office, 600 sq. ft.; composing room, 1,200 sq. ft.; pressroom, 1,800 sq. ft.; bindery, 2,500 sq. ft.; storeroom, 900 sq. ft.

4. The Fair Store occupies a three-story building 60 ft. by 120 ft. for which they pay a yearly rental of $15,000. They maintain six departments designated as A, B, C, D, E, and F. Department A occupies 60 ft. by 80 ft. on the first floor; Department B, the remainder of this floor; Department C occupies 30 ft. by 60 ft. on the second floor; Department D, the remainder of the second floor; Department E occupies 60 ft. by 90 ft. on the third floor, and Department F, the remainder of this floor. You are to show the proper distribution of the monthly rent over these six departments.

Many of the problems of the manufacturer are also the problems of the merchant, especially those relating to the proper allocation of operating costs to the different departments.

5. The Day Machine Shop occupies two floors of a building 190 ft. by 200 ft. for which it pays an annual rental of $7,500. It is desired to allocate the monthly rent over six departments designated as Nos. 1, 2, 3, 4, 5, and 6. Department No. 1 occupies $\frac{3}{5}$ of the first floor; Department No. 2, $\frac{2}{5}$ of the remainder, and Department No. 3, the remainder of the first floor. Department No. 4 occupies $\frac{1}{4}$ of the second floor; Department No. 5, $\frac{2}{5}$ of the second floor, and Department No. 6, the remainder.

EXERCISE No. 219, DISTRIBUTION OF TAXES AND DEPRECIATION

In a manufacturing business it is necessary to have machines to manufacture the products of the factory. The owner will be required to pay personal property tax on the value of this property. This tax is one of his operating expenses, hence should be distributed over each department on a basis of property valuation in the department. To make this distribution, it is necessary to multiply the total amount paid for taxes by a fraction of which

the total value of the property is the denominator, and the value of the property in the department, the numerator.

The machinery used in each department will depreciate because of wear. This is also a charge against the department. The amount of this charge is ascertained by taking a certain per cent of the cost value of the machinery. Each department is charged with the depreciation on the property used in the department.

The following problems provide written practice in distributing the cost of taxes over each department based on a hundred-dollar-unit of property valuation, and in ascertaining the depreciation on the machinery used in each department. You are to show on tablet paper all the calculations necessary to obtain the tax cost separate from the depreciation cost.

1. The Mason Manufacturing Company has four departments and the office, designated as departments A, B, C, D, and O. The cost value of the property in each department is as follows: Department A, $12,986.42; Department B, $21,487.36; Department C, $9,017.55; Department D, $18,513.44; Department O, $4,225.90. The amount of taxes paid during a certain year was $2,165.90, and the rate of depreciation in each department was 15%.

Applying the hundred-dollar-unit basis, the value of Department A would be stated as $13,000, Department B, $21,500, Department C, $9,000, Department D, $18,500, and Department O, $4,200.

2. The value of the property* in the seven departments in the Thompson Manufacturing Company mentioned in problem 1, of the preceding exercise, is as follows: Department A, $18,500; Department B, $12,500; Department C, $22,500; Department D, $25,400; Department E, $1,740; Department F, $1,255; Department G, $2,500. The taxes paid by this company were at the rate of $28.50 per thousand. The depreciation applicable to the machinery in each department was, A, 12½%; B, 15%; C, 10%; D, 13%; E, 15%; F, 12½%; and G, 20%.

3. The total value of the property in the four departments of the Davidson Garage referred to in problem 2 of Exercise No.

*The term "property" as used here refers to the machinery and other equipment used in the different departments. The accounting term for property of this character is "fixed assets".

218 was $9,960. $\frac{1}{3}$ of this was in Department A, $\frac{1}{4}$ of the remainder in Department B, $\frac{1}{2}$ of the remainder in Department C, and the remainder in Department D. The taxes paid during the current year were $987.65, and the rate of depreciation in each department was 15%.

4. The Newman Printing Company mentioned in problem 3, Exercise No. 218, paid $1,246.85 taxes during the current year and depreciated the property in each department at 20%. The valuation of the property in the office was $2,000; composing room, $5,800; pressroom, $14,500; bindery $6,750; storeroom, $500. Allocate the taxes, and the depreciation cost in each department on a basis of property valuation.

5. The value of the property in the six departments of the Day Machine Shop in problem 5, Exercise No. 218, is as follows: No. 1, $22,500; No. 2, $5,480; No. 3, $1,250; No. 4, $4,465; No. 5, $9,800; No. 6, $1,248. The depreciation applicable in each department is, No. 1, 15%; No. 2, 12½%; No. 3, 15%; No. 4, 20%; No. 5, 18%; No. 6, 16%. The taxes paid during the year were $1,004.78.

EXERCISE No. 220, DISTRIBUTION OF SUPERINTENDENT'S SALARY

The superintendent's salary is usually distributed on a basis of the number of productive machine hours which each department produces. The method of distribution is the same as rent, except the total machine hours are used as the denominator of the fraction, and the number of hours produced in each department as the numerator.

Machine hours refers to the number of hours produced by a machine or group of machines of the same size without reference to the number of men required to operate the machine or groups of machines.

The following problems provide written practice in distributing a superintendent's salary on the productive machine hour basis.

1. The superintendent of the Newman Printing Company receives a salary of $6,300 per year. This is distributed over the various departments on a basis of the actual number of productive machine hours. During the month of September, the production was as follows: Composing room, 1,530 hours; pressroom, 1,240 hours; bindery, 1,350 hours; storeroom, 250 hours. Show the allocation of the superintendent's salary for the month of September.

2. The superintendent of the Thompson Manufacturing Company receives a salary of $5,580 per year. Only five of the seven departments are producing centers and under the supervision of the superintendent. During April, Department A produces 11,425 hours; Department B, 6,780 hours; Department C, 8,975 hours; Department E, 7,500 hours; Department G, 2,520 hours. You are to show the proper allocation of the monthly salary of the superintendent based on the actual number of hours.

3. The salary of the superintendent for the Davidson Garage is $4,800 per year. This is to be allocated to the four departments according to the number of employees in each department. Department A has 5 employees; Department B, 12; Department C, 10; Department D, 5. Show the allocation of the salary of the superintendent for the month of June based on the actual number of employees.

4. The Robbins Machine Tool Company pays its superintendent $13,500 per year. This is allocated monthly to the five different departments. During a certain month, Department A produced 18,000 hours; Department B, 16,716 hours; Department C, 9,421 hours; Department D, 10,016 hours; and Department E, 8,412 hours. The distribution is to be made on a 100-hour-unit basis. You are to ascertain the allocation of the superintendent's salary for that month to the five different departments.

5. The superintendent of the Day Machine Company receives a salary of $7,560 per year. This is distributed on a basis of the actual number of employees in each department as follows: No. 1, 75; No. 2, 40; No. 3, 15; No. 4, 25; No. 5, 12; No. 6, 8. Show the proper allocation of the superintendent's salary for the month of May.

EXERCISE No. 221, DISTRIBUTION OF POWER

Each machine should be equipped with an electric motor, thus effecting a saving in the power necessary to operate the machine. It may not be necessary to operate all the machines at one time, hence a separate motor in each machine will permit individual operation. The cost of power, which is the amount paid for electricity used in operating the motors which operate the machines, should be allocated to each department. This allocation is made on a basis of productive hours and horse power (H. P.), because if a machine is not operating, fewer productive

hours will be produced in the department. The greater the horse power of a machine, the more electricity required to operate its motor.

Thus, if there were three departments and Department A has 2 H. P., Department B, 6 H. P., and Department C, 4 H. P., and Department A produced 500 hours, Department B, 1,200 hours, and Department C, 800 hours, the numerator of the fraction applicable to Department A would be 1,000, Department B, 7,200, and Department C, 3,200, and the denominator would be the sum of these three numbers or 11,400. If the cost of electricity for a given month was \$100, $\frac{1000}{11400}$ of this would be applicable to Department A, $\frac{7200}{11400}$ of it, to Department B, and $\frac{3200}{11400}$, to Department C.

1. The Newman Printing Company has four departments, composing room, pressroom, bindery, and stockroom. The horse power of the machines in the composing room is 2; pressroom, 16; bindery, 6; and stockroom, 6. During the month of October these departments produced the following productive machine hours: composing room, 175; pressroom, 1,350; bindery, 1,075; stockroom, 130. The cost of the electric current used by these machines during the month was \$145.40. It is desired to allocate this cost to each of the four departments.

2. The Thompson Manufacturing Company pays \$224.50 for electric power during the month of October. This is to be distributed to Departments A, C, D, and E. Department A requires 22 H. P.; Department C, 18 H. P.; Department D, 6 H. P.; Department E, 20 H. P. Department A produced 1,200 hours; Department C, 1,600 hours; Department D, 1,100 hours; Department E, 1,400 hours. Show the charge to be allocated to each department for its share of the cost of the power.

3. The Davidson garage has four departments. Department A, requires 3 H. P.; Department B, 18 H. P.; Department C, 12 H. P.; Department D, 8 H. P. The cost of electricity purchased during the month of March for operating the machines was \$239.85. You are to distribute this over the four departments assuming that the productive hours in each department are the same.

4. The Fair Store mentioned in problem 4, Exercise No. 218, does not have machines operated by power, but does use electricity for lighting the departments. During the month of December the cost of electricity was \$97.20. This is to be allocated to each of the departments on a basis of the number of square feet in the

department. Show the proper allocation of this electric light cost over the six departments.

5. The Day Machine Shop has power machines in three of its six departments. Department No. 1 requires 22 H. P.; Department No. 4, 26 H. P.; Department No. 6, 12 H. P. The number of hours produced by Department No. 1 was 2,125; Department No. 4, 1,645; and Department No. 6, 875. During the month of August the cost of electricity for power is $550.11. You are to allocate this to the three departments affected on a basis of horse power and productive machine hours.

EXERCISE No. 222, PROFIT ON SALES

The merchant and the manufacturer both have the same problem, in that the profit made by selling merchandise must be sufficient to pay all operating expenses, and provide a net profit for the owners of the business. The merchant ascertains his profit on sales through deducting the cost of the goods purchased from the sales, while the manufacturer ascertains his profit by subtracting the cost of the goods manufactured from the sales.

The solution below shows the process of ascertaining the profit on sales through the operations of the Grau Manufacturing Company during a certain year. The facts from which this information is obtained are as follows: Sales, $85,608.40; beginning inventory of raw material, $9,421.87; purchases of raw material, $32,982.50; labor, $16,421.80; manufacturing expense, $7,236.55; raw material on hand at the end of the year, $9,455.80.

Sales			$85,608.40
Beginning R. M. Inventory	$ 9,421.87		
Purchases	32,982.50		
Labor	16,421.80		
Manufacturing Expense	7,236.55	$66,062.72	
Less Ending R. M. Inventory		9,455.80	
Cost of Merchandise Sold			56,606.92
Net Profit			$29,001.48

The total sales are placed at the right so that the cost may be deducted. The cost of material at the beginning of the year plus all the costs during the year are placed at the left so that they may be added and carried to the right and from this deduct the ending inventory. The cost of the raw material on hand, plus the purchases, plus labor, plus the manufacturing expense, less the inventory at the end of the year is the cost of the raw material, labor, and manufacturing expense utilized in the merchandise sold during the year. The difference between the sales and the cost of the sales is the profit made by manufacturing and selling merchandise.

The following problems provide written practice in ascertaining the net profit as a result of manufacturing and selling merchandise. You are to show on tablet paper all the calculations necessary to ascertain this information, arranging your work in the same form as in the illustration.

1. The L. A. Brewer Manufacturing Company had on hand at the beginning of the current business year raw material to the value of $16,492.55. During the year the value of the raw material purchased was $21,416.30. The cost of labor during the year was $9,422.16 and manufacturing expense, $6,227.41. The inventory of raw material at the end of the year was $14,219.65. The sales for the year were $52,417.19.

2. The following figures were taken from the books of the A. B. Sanford Company during a period of five years:

	Inventory	Purchases	Labor	Mfg. Exp.	Sales
a.	$32,514.91	$63,421.90	$18,437.15	$ 906.27	$127,962.44
b.	30,327.62	67,236.80	17,219.65	10,948.32	135,518.72
c.	38,109.30	66,721.91	18,728.88	8,542.99	141,432.98
d.	40,487.22	55,304.09	19,437.62	10,533.34	129,786.55
e.	29,161.80	70,134.50	22,518.90	11,542.54	139,963.27

The beginning inventory in problem "a" is the amount given as the first item in the problem, and the ending inventory is the inventory given in problem "b". You are to ascertain the profit on the sales for each of these years, the ending inventory for problem "e" being $38,671.29.

CHAPTER XXVI

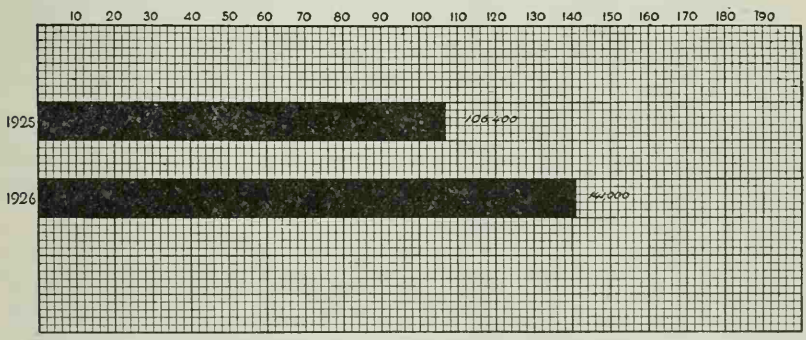
GRAPHS

A *graph* is a drawing, the purpose of which is to set forth to the eyes in true proportion the relation between certain statistical facts. Graphs afford a very convenient means of presenting to the business man facts concerning his business, and their relation to its operation and progress. The meaning and purpose of graphs are best explained through the illustrations and problems in this chapter.

EXERCISE No. 223, HORIZONTAL BAR GRAPHS

The *bar graph* is one that sets forth the comparison of certain mathematical facts by means of bars of different lengths. These bars are usually drawn on scale paper so as to permit a definite interpretation. The illustration below shows a horizontal bar graph setting forth a comparison of sales of a business concern on a hundred-dollar-unit basis over a period of two years, these sales expressed in figures being:

1925.....$106,431.29 1926.....$141,010.39



In this graph the vertical lines each represent a unit value of $2,000. Thus, each five units, as indicated by the heavy line, represents $10,000. You can readily see that it is much easier to interpret the increase or decrease in sales from these bars, than from the same facts stated in figures.

The following problems provide written practice in preparing bar graphs. If possible, use the paper ruled for the preparation of graphs, but if this is not available, then draw lines on tablet paper as near to the scale as possible.

1. The sales of the Johnson Publishing Company for three consecutive years were as follows: first year, $68,527.50; second year, $72,209.11; and third year, $75,516.40. Set forth these facts in a horizontal bar graph using $1,000 as a unit.

2. The manager of the Fair Store asks you to prepare in a horizontal bar graph the following facts regarding the expenses of operating the business during the current year. The selling expenses were as follows: salaries of sales clerks, $22,565; salary of sales manager, $5,000; advertising, $4,565.20. The general expenses were as follows: officers' salaries, $18,500; rent, $9,000; store supplies used, $1,965.50; miscellaneous supplies $2,560.75. The comparison of these expenses should show the relation of (a) each selling expense to the total selling expense, and (b) each general expense to the total general expense.

3. The incomes of four salesmen employed by the Michael's Manufacturing Company for the current year were as follows:

Names	Salary
R. E. Douglas	$7,500
H. C. Jameson	9,426
H. Y. Joiner	6,954
R. T. Lee	9,562

Set forth the above facts in a horizontal bar graph using $100 as a unit.

4. The attendance of a certain high school during three consecutive years was as follows: first year, 1,655; second year, 1,875; third year, 2,155. Show these facts in a horizontal graph using a twenty-five-unit basis.

5. The tax rate in a certain community for a period of five years was as follows: first year, $22.50 per thousand; second year, $25.40 per thousand; third year, $27.60 per thousand; fourth year, $24.70 per thousand; and fifth year, $22.90 per thousand. Present these facts in ten-cent units on a horizontal bar graph.

6. The receipts of the Acme Theater during a period of four weeks were as follows: first week, $2,250.65; second week,

$4,142.55; third week, $3,541.75; and fourth week, $2,627.25. Present these facts on a horizontal bar graph in $25 units.

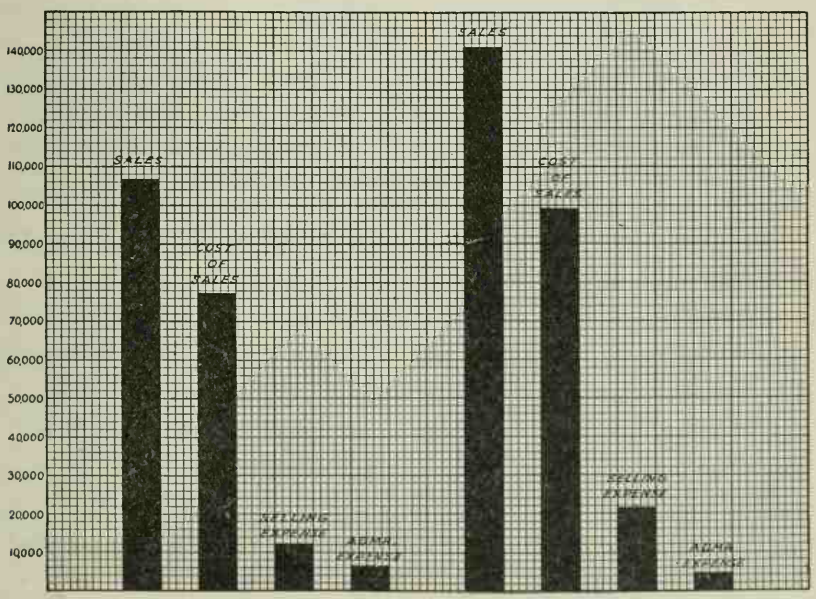
7. Albany, Utica, and Rochester are on the main line of the New York Central Railroad between New York and Buffalo. The distance between New York and Buffalo is 438 miles; between New York and Albany is 142 miles; between Albany and Utica is 96 miles; and between Utica and Rochester is 124 miles. Set forth these facts in a horizontal bar graph in ten-mile units.

EXERCISE No. 224, VERTICAL BAR GRAPHS

The vertical graph differs from the horizontal graph only in the method of making the drawing. The parallel lines in the vertical graph are drawn from top to bottom, while in the horizontal graph, they are drawn from left to right.

The illustration below shows a vertical bar graph setting forth a comparison of the sales, cost of sales and expenses of the Davidson Mercantile Company for the years 1925 and 1926.

	Sales	Cost of Sales	Selling Expense	Administrative Expense
1925...	$106,410.50	$77,476.40	$12,010.30	$6,350.75
1926...	141,002.60	99,210.50	21,751.25	4,220.80



The following problems provide practice in drawing vertical bar graphs to portray facts presented by figures. Use regular graph paper, if available; but if not, make your drawings to a scale on tablet paper.

1. The sales and cost of sales as recorded in the ledger of the Johnson Company for a period of four years were as follows:

	Sales	Cost of Sales
First year	$40,161.50	$19,271.90
Second year	44,992.54	21,217.75
Third year	32,516.46	26,218.75
Fourth year	48,219.73	25,516.73

Prepare a vertical bar graph showing the facts regarding the sales of the Johnson Company using a $1,000 unit basis.

2. The Marland Manufacturing Company employs four salesmen. During January the sales and selling expenses of each of the salesmen were as follows:

	Sales	Selling Expenses
A. L. Dick	$ 9,471.80	$408.75
J. B. Morse	1,216.55	206.47
C. J. Arnold	7,216.48	315.48
T. B. Morris	11,560.27	389.59

Prepare a vertical bar graph showing a comparison of the sales of each salesman with his selling expenses, using $100 units as a basis for the sales, and the selling expenses.

3. The sales of the Text Book Publishing Company during a certain year were as follows:

January	$20,483.78	July	$14,491.74
February	18,560.37	August	14,932.57
March	12,416.55	September	48,415.83
April	7,918.54	October	32,316.37
May	4,751.38	November	20,156.40
June	6,281.80	December	16,473.83

Prepare a vertical bar graph showing a comparison of the sales for each month of the year using $500 units as a basis.

4. Construct a bar graph showing a comparison of the per capita wealth of the following ten cities, using $100 units as a basis.

Chicago.....	$1,239	Los Angeles.....	$2,646
Cincinnati.....	2,376	New Orleans....	1,290
Cleveland.....	2,801	New York.....	1,964
Detroit.....	2,644	Pittsburgh.....	1,992
Kansas City....	2,203	San Francisco...	3,401

5. The following statistics were given out by the street railways of a leading city. Average number of passengers carried per day 433,000, distributed over the hours of the day as follows:

	Per Hr.		Per Hr.
From 5 to 6 a. m...	13,000	From 3 to 4 p. m...	23,000
From 6 to 7 a. m...	29,000	From 4 to 5 p. m...	25,000
From 7 to 8 a. m...	52,000	From 5 to 6 p. m...	68,000
From 8 to 9 a. m...	34,000	From 6 to 7 p. m...	29,000
From 9 to 10 a. m...	15,000	From 7 to 8 p. m...	19,000
From 10 to 11 a. m...	13,000	From 8 to 9 p. m...	12,000
From 11 to 12 a. m...	13,000	From 9 to 10 p. m...	10,000
From 12 to 1 p. m..	15,000	From 10 to 11 p. m...	12,000
From 1 to 2 p. m..	20,000	From 11 to 12 p. m...	8,000
From 2 to 3 p. m..	20,000	From 12 to 5 a. m...	3,000

(a) Construct a bar graph to show the day's traffic in hourly comparisons using $1,000 units as a basis; (b) what per cent of the total traffic is between the hours of 5 and 6 p. m.; (c) what per cent between 7 and 8 a. m.?

6. The annual shipment of oranges from California for eight consecutive years was as follows:

First Year...	10,200,000 boxes	Fifth Year....	15,300,000 boxes
Second Year..	10,800,000 boxes	Sixth Year....	13,800,000 boxes
Third Year...	13,200,000 boxes	Seventh Year.	6,300,000 boxes
Fourth Year..	10,600,000 boxes	Eighth Year..	17,900,000 boxes

Construct a bar graph showing a comparison of the shipments for eight years, using the current year as the eighth year, and the seven preceding years as the others. Use 100,000 as a basis.

7. During a period of one year the average price of sugar was as follows:

January	6.4c	July	8.1c
February	6.5c	August	7.9c
March	6.7c	September	7.9c
April	6.6c	October	8.1c
May	7.1c	November	8.3c
June	7.6c	December	8.7c

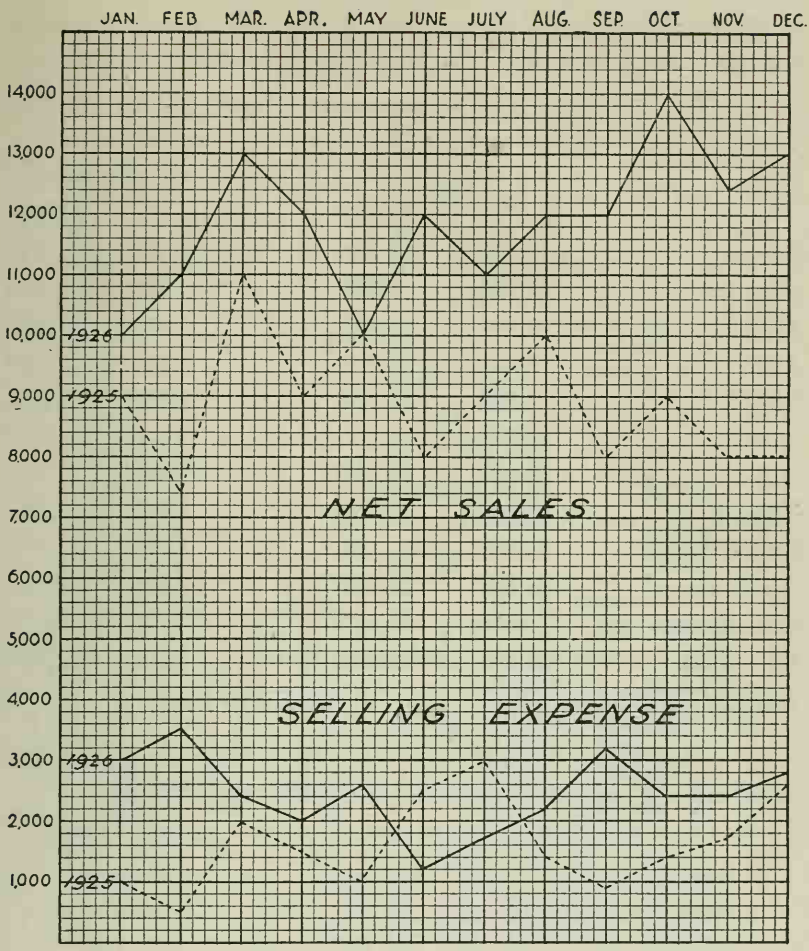
Construct a vertical bar graph showing a comparison of the price of sugar during each of the twelve months of the year, using one cent as a basis.

EXERCISE No. 225, CURVED GRAPHS

A *curved graph* may be used for the same purpose as a bar graph. When there are a number of figures which have a certain relation to each other and to a whole, the curved graph will show this relation even better than the bar graph.

The illustration below shows the curved graph illustrating the sales and selling expenses of a firm over a period of two years. The facts from which this graph was made are as follows:

	Sales		Selling Expenses	
	1st Yr.	2d Yr.	1st Yr.	2d Yr.
January	$ 9,000	$10,000	$1,000	$3,000
February	7,400	11,000	500	3,500
March	11,000	13,000	2,000	2,400
April	9,000	12,000	1,500	2,000
May	10,000	10,000	1,000	2,600
June	8,000	12,000	2,500	1,200
July	9,000	11,000	3,000	1,700
August	10,000	12,000	1,400	2,200
September	8,000	12,000	900	3,200
October	9,000	14,000	1,400	2,400
November	8,000	12,400	1,700	2,400
December	8,000	13,000	2.600	2,800



The sales at the end of January of the first year were $9,000, hence the line begins at the point where the $9,000 line and the end of January meet. The sales for the month of February of the first year decreased $1,600, hence the line goes down to the point where $7,400 and March meet. There was an increase of $3,600 in March, hence the line goes up to a point where March and $11,000 meet, etc. A dotted line is used for the first year and a solid line for the second year in order to distinguish between them. The selling expenses are shown at the bottom, because the amounts are smaller. The plan is the same, the dotted line is used for the first year, and a solid line for the second year. This graph presents interesting facts to the owner of the business, from which he can determine a comparison of sales for two years and the cost of selling for the same period.

The following problems provide written practice in preparing curved graphs.

1. The sales and cost of sales of the Jewell Mercantile Co. during a period of two consecutive years were as follows:

	Sales		Cost of Sales	
	1st Yr.	2d Yr.	1st Yr.	2d Yr.
January	$20,000	$22,000	$1,500	$1,300
February	22,500	24,000	1,200	1,300
March	23,000	24,500	1,300	1,200
April	25,000	26,500	1,350	1,250
May	27,000	28,000	1,500	1,350
June	30,000	34,000	1,500	1,200
July	35,000	33,000	1.600	1,400
August	32,500	31,000	1,700	1,300
September	27,000	29,000	1,500	1,500
October	26,000	28,500	1,300	1,400
November	25,500	26,000	1,200	1,100
December	25,000	25,500	1,200	1,000

Prepare a curved graph setting forth the above facts.

2. Prepare a curved graph showing a comparison of the sales and cost of sales as shown by the following figures:

	Sales	Cost of Sales
January	$49,400	$34,250
February	47,200	33,800
March	43,150	31,750
April	49,600	34,500
May	47,000	32,500
June	45,500	31,700
July	45,400	32,000
August	48,400	35,200
September	56,000	33,700
October	47,800	33,200
November	47,200	33,600
December	54,600	35,500

3. Prepare a curved graph showing a comparison of the sales and cost of sales as shown by the following figures:

	Sales	Cost of Sales
January	$52,500	$34,250
February	49,700	33,800
March	45,250	31,750
April	52,600	34,500
May	50,200	32,500
June	48,300	31,700
July	47,500	32,000
August	51,600	35,200
September	53,400	33,700
October	50,500	34,200
November	49,700	33,600
December	57,800	35,500

4. The table below shows the sales of the millinery department of the H. S. Pogue Company for two years. From this information, prepare a curved graph showing a comparison of the sales for two years. Use a dotted line to show sales for the first year and a solid line for the second year's sales.

Month	1st Year	2d Year	Month	1st Year	2d Year
Jan.	$1,000	$1,200	July	$1,830	$1,960
Feb.	1,150	1,300	Aug.	1,910	1,890
Mar.	1,920	1,800	Sept.	2,050	2,150
Apr.	1,600	1,850	Oct.	2,160	2,270
May	1,510	1,600	Nov.	1,900	1,800
June	1,730	1,900	Dec.	1,530	1,620

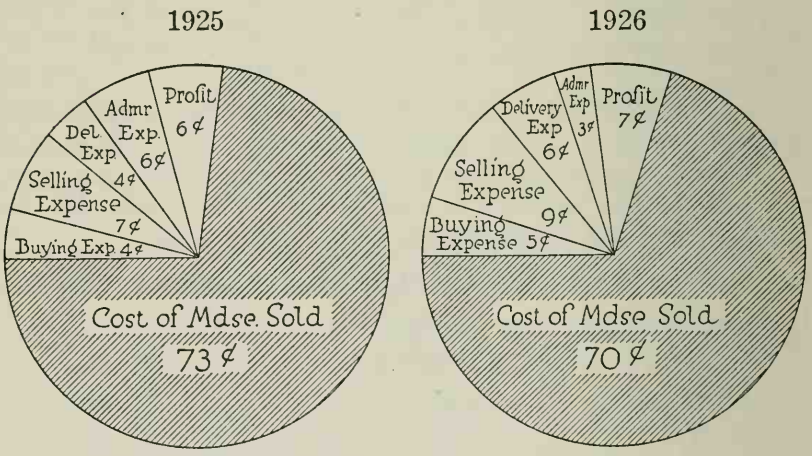
EXERCISE No. 226, CIRCLE GRAPHS

The *circle graph* may be used for the same purpose as the bar graph and the curved graph, but it is better adapted to the presentation of facts on a percentage or dollar basis. Thus, each dollar of sales made by a merchant must include: (a) the cost of mer-

chandise sold (invoice cost, plus transportation cost, and buying expense); (b) the various selling expenses; (c) the various general expenses; and (d) the profit.

The illustration below shows a circle graph applicable to each dollar of sales for a period of two years. The facts from which these graphs were prepared are as follows:

	First Year	Second Year
Cost of Merchandise Sold.....	$14,965.00	$15,697.50
Buying Expense.....	820.00	1,121.25
Selling Expense.....	1,435.00	2,018.25
Delivery Expense.....	820.00	1,345.50
Administrative Expense.....	1,230.00	672.75
Profit.....	1,230.00	1,569.75



Costs and Profit in Each One Dollar Sale

You will observe in the above illustrations, that the hundred cents in each dollar are included. In the first year, the cost of the merchandise sold was 73c; the buying expense, 4c; the selling expense, 7c; the delivery expense, 4c; the administrative expense, 6c; and the profit, 6c. During the second year the cost of the merchandise sold was reduced to 70c, but the buying expense cost 1c more, the selling expense increased 2c and the delivery expense increased 2c. The administrative expense was one half of what it was the first year, and the profit was 1c more. These facts will help the merchant to decrease his costs and increase his profits for the next year.

The following problems provide written practice in: (a) ascertaining the per cent of the various costs; and (b) presenting these values in cents using a circular graph. You are to prepare circular graphs giving the desired information as shown in the illustration.

1. The cost of sales, expenses in connection with the operation of the business, and the profit shown on the report received by Mr. Arnold of the Arnold Publishing Company for a certain year were as follows:

Cost of Merchandise Sold	$52,810.24
Buying Expense	3,300.64
Selling Expense	9,076.76
Delivery Expense	1,650.32
Advertising Expense	4,950.96
Administrative Expense	4,950.96
Profit	5,776.12

2. The cost of sales, selling expense, general expense, and profit of the D. C. Dirck Company during a certain year were as follows:

Cost of Merchandise Sold	$108,917.60
Selling Expense	40,417.81
General Expense	20,214.55
Profit	46,964.44

3. Prepare a circular graph for problem 1 in Exercise No. 222.

4. Prepare a circular graph for the Dixie Confectionery Store based on the following facts: cost of merchandise sold, 49c; buying expense, 11c; selling expense, 5c; delivery expense, 9c; administrative expense, 9c; profit, 17c.

5. Prepare a circular graph setting forth the following facts obtained from the operation of the Kenner Drug Company: cost of merchandise sold, 64c; buying expense, 8c; selling expense, 6c; delivery expense, 4c; administrative expense, 6c; profit, 12c.

CHAPTER XXVII

BUSINESS OWNERSHIP

The purpose of a business is to provide merchandise or service. All need clothing, hence we have businesses organized to supply clothes, which is a form of merchandise. All must eat, hence we have businesses organized for the purpose of selling groceries, which is one form of merchandise. Those who have money need a safe place to keep it, and those who wish to borrow money need a place from which to borrow it, hence we have banks to perform these services. Many need to travel from one place to another, hence we have railroads to render this form of service. Rapid communication is sometimes necessary and always convenient, hence we have businesses organized for the purpose of providing telephone and telegraphic service.

A business can supply merchandise or services which it offers for sale only through the ownership of property. The clothing merchant could not sell clothes unless he had the clothes to sell, and these are property. The grocer could not sell groceries unless he had the groceries to sell, and these are property. The bank could not lend money unless it had money to lend, and money is property. The railroad company could not provide transportation services unless it owned engines, cars, tracks, and other necessary property. The telegraph and telephone companies could not render communication services without the necessary equipment, and this equipment is property. It is through the use of property that the many business concerns can provide the merchandise or services desired.

All property has ownership. This includes not only real estate, but also personal property, household furnishings, automobiles, clothes, and various other forms of movable property. This ownership may be vested in: (1) one individual; (2) two or more individuals; or (3) a corporation. There is no other form of ownership except governmental, but the purpose of governmental ownership is not to operate a business, but to render the services for which the citizens pay through taxation.

SOLE PROPRIETORSHIP

When the title to property is vested in one individual, he is its sole owner, and can do as he will with the property, subject at all times to laws enacted to protect the rights of others. The total value of all the property owned by an individual, and used in the operation of his business, is known as his *proprietorship in the business.* The various kinds of property used in the operation of a business will be determined by the nature of the business. Thus, a telephone company will own some property of a different nature than that owned by a bank, and a bank will own some property of a different nature than that owned by a railroad company; on the other hand, each may own property of the same nature.

The one who owns and operates a business may not have a full proprietary interest in the property belonging to the business because of debts which will have to be paid out of the business assets. His debtors have a claim against the property, hence their claim must be given consideration when determining the net proprietorship of the owner. For this reason the net proprietorship of a business is the value of all the property that it owns less the sum of its debts. The property owned by a business is usually referred to as its *assets,* and the debts it owes as its *liabilities.** The equation

$$\text{Assets} - \text{Liabilities} = \text{Proprietorship}$$

is based on the foregoing statements.

The illustration at the top of page 356 shows one method of ascertaining the net proprietorship of R. A. Watson, a retail merchant. The assets owned by Mr. Watson are: cash, $1,527.65; notes receivable, $587.50; merchandise inventory, $3,781.92; accounts receivable, $1,271.55; furniture and fixtures, $800; delivery equipment, $1,200. Mr. Watson's liabilities are, a note due The First National Bank for $500, and accounts due wholesale houses from which he has purchased merchandise, $872.

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*The rights of an individual in the property which he owns, but which is not used in the operations of a business is usually referred to as his *equity* in the property. Thus, if A. L. Strong purchases a home for $10,000 and pays only half of the purchase price, his equity in the home is $5,000; if he pays all of the purchase price, his equity is $10,000.

R. A. WATSON

Balance Sheet, July 31, 19..

Assets			*Liabilities*		
Cash	$1,527	65	Note Due		
Notes Receivable	587	50	First Nat'l Bank	$ 500	
Merchandise Inventory	3,781	92	Accounts Due		
Accounts Receivable	1,271	55	Wholesale Houses	872	
Furniture & Fixtures	800		Proprietorship		
Delivery Equipment	1,200		R. A. Watson, Capital	7,796	62
	9,168	62		9,168	62

A list of the assets, liabilities and proprietorship of an individual or business is known as a *Balance Sheet.* It is customary to list assets on the left and liabilities on the right.

The facts shown on the Balance Sheet are obtained from the bookkeeping records. You will learn through a study of bookkeeping the meaning of the assets and liabilities, and the method of recording transactions so as to have available the desired information regarding each asset, liability, and the proprietorship.

EXERCISE No. 227, SOLE PROPRIETORSHIP

When one individual owns the property used in the operations of a business, it is said to be a *sole proprietorship.* He owns all the assets, but his net ownership is the difference between the total assets and the total liabilities.

The following problems provide written practice in preparing Balance Sheets. Arrange in the same form as the illustration.

1. L. J. Woodward is the proprietor of a drug store. On June 30, his assets and liabilities were as follows:

Drugs and Other Merchandise on Hand	$3,472.57
Showcases and Cabinets	458.72
Soda Fountain	427.00
Cash	1,532.59
Owed First National Bank	451.00
Owed Wholesale Druggists	532.45

Prepare a Balance Sheet showing total assets, total liabilities, and proprietorship.

2. Prepare a Balance Sheet for C. B. Moore, showing his net proprietorship on June 30 from the following facts: cash, $5,146.75; accounts receivable, $21,386.25; merchandise stock, $20,475.61; furniture and fixtures, $1,145.35; *deferred expenses, $475.25; notes payable, $4,000; accounts payable, $14,519.75.

*Deferred expenses are office supplies, shipping room supplies and other expense items which have been purchased but not consumed at the time the balance sheet is prepared.

3. Prepare a Balance Sheet for C. B. Moore as of Sept. 30, from the following facts: cash, $3,268.55; accounts receivable, $14,518.90; notes receivable, $4,500; merchandise stock, $34,515.55; furniture and fixtures, $1,215.80; deferred expenses, $327.80; notes payable, $5,000; accounts payable, $15,581.85.

4. Mr. Moore (problems 2 and 3) wishes to know (a) the increase or decrease, and (b) the per cent of increase or decrease, in his proprietorship as a result of the business operations for the months of July, August, and September. Show all the calculations necessary to ascertain the desired information.

5. December 31, M. A. Patterson owned property and owed debts as follows: cash, $3,514.62; pianos in stock, $3,560; furniture and fixtures, $540; delivery truck, $1,400; office supplies, $72.15; he owed American Piano Company, $850; note payable, $3,500. On March 31, he owned property and owed debts as follows: cash, $5,745.20; pianos in stock, $2,640; furniture and fixtures, $540; delivery truck, $1,300; office supplies, $83.50; he owed American Piano Company, $350; note payable, $3,500. You are to prepare: (a) a Balance Sheet as of December 31; (b) a Balance Sheet as of March 31; (c) and show the increase or decrease in proprietorship.

6. Robert Stuart owned property and owed debts as follows on May 31: cash, $1,452.45; merchandise stock, $2,548.80; furniture and fixtures, $350; delivery equipment, $1,200; office supplies, $40.85; he owed the Creasey Grocery Company, $432.75; he owed the Foltz Grocery Company, $345.65. Prepare a Balance Sheet for Mr. Stuart as of May 31.

7. Richard Warner owned property and owed debts on April 30 as follows: cash, $1,578.35; merchandise stock, $4,506.60; furniture and fixtures, $500; land and buildings, $8,500; office

supplies, $75; note due Fourth National Bank, $3,500; accounts due creditors, $865.80. Prepare a Balance Sheet for Mr. Warner as of April 30.

8. J. L. Jardine owned property and owed debts on February 28 as follows: cash, $1,827.55; a note signed by J. L. Brown for $52.40; accounts receivable as follows—James Miller, $271.45, W. H. Williams, $371.19, W. S. Dale, $426.45, C. H. Gifford, $267.60, and U. T. Best, $217.14; the value of stock as per inventory is $1,762.55; furniture and fixtures in the office, $525.50; office supplies on hand, $1,445; insurance premiums paid in advance, but not yet expired, $32.75; he owed a note given to Borcher Brothers for $87.65; he owed A. Adams & Son, $113.50; he owed C. T. Matson, $317.45. It is desired to know his net proprietorship on February 28.

9. March 31, J. L. Jardine owned property and owed debts as follows: cash, $1,415.65; a note signed by J. L. Brown for $52.40; accounts receivable as follows—James Miller, $178.60, W. H. Williams, $417.55, W. S. Dale, $113.50, C. H. Gifford, $365.50, and U. T. Best, $441.55; merchandise inventory, $2,515.55; furniture and fixtures, $525.50; office supplies on hand, $42.50; unexpired insurance, $27; he owed A. Adams & Son an account of $113.50; and he owed C. T. Matson an account of $200. You are to prepare a Balance Sheet showing his net proprietorship on March 31.

10. Mr. Jardine (problems 8 and 9) wishes to know the increase or decrease, and the per cent of increase or decrease, in his proprietorship as a result of the business operations for the month of March. Show all the calculations necessary to ascertain the desired information.

11. J. L. Crenshaw, a retail grocer, owned property and owed debts as follows on January 31: cash, $341.75; a note in his favor signed by C. H. Perry for $98.50; accounts due from customers as follows—C. H. Heile, $13.85, Newland Hotel, $69.65, J. H. Charter, $15.55; the value of merchandise in stock was $3,715.40; furniture and fixtures, $328.50; unexpired insurance, $22.95; office supplies on hand, $16.40; he owed the Union Bank a note for $125; he owed the following creditors—Pure Products Company, $101.65, Colter Grocery Company, $152.40, Midland Grocery Company, $54.50. (a) Prepare a

Balance Sheet showing the net proprietorship of Mr. Crenshaw; (b) ascertain the per cent of profit or loss, if his proprietorship on the preceding January was $4,365.98.

You will observe from the solution of the foregoing problems that the sum of all the assets minus the liabilities is the owner's net proprietorship in the property belonging to the business. This is always true from a mathematical standpoint, but it does not mean that a creditor can take possession of any property which he has sold to the debtor in order to adjust his claim. You will learn in the study of commercial law, the procedure provided by law for the creditor to collect his claim in case it is necessary to do so. In arithmetic, you learn that assets minus liabilities equals net proprietorship; in accounting you learn the reason for this, and the method of securing the facts necessary to apply it; and in law you learn the legal effect of this equation, and the method of applying it.

12. December 31, A. L. DeArmand, a farmer, owned property and owed debts as follows: farm land and buildings, $21,500; farm tools and equipment, $2,751.65; horses and wagons, $850; tractor, $1,150; other farming implements, $500; cows and hogs, $1,200; wheat, corn, and other grain, $3,250; prepaid insurance on buildings, $120; he had deposited in the Farmers Bank, $215.50; he owed Central Life Insurance Company a mortgage for $5,000; he owed Farmers Bank a note for $500; and, Merchants National Bank a note for $306. What was his net proprietorship?

13. If Mr. DeArmand, mentioned in the preceding problem, had a net proprietorship of $21,820 on the first of the year, and the expense of operating the farm during the year had been $1,116.50; what would have been his gross profit from operating the farm during the year?

14. A. L. Dickson owned the following property on December 31: store building at 718 Main Street, $18,500; house and lot at 2217 Gay Street, $14,500; lot No. 17 in the Day Addition, $550; United States Bonds, $4,000; state bonds, $2,500; city bonds, $4,000; cash in the First National Bank, $2,716.50; notes for $2,250 received in part payment of real estate sold. He owed a mortgage on the Main Street property of $10,000; and he owed the First National Bank a note for $2,000. What was his net proprietorship?

15. T. C. Dakin operated an auction room where he offered at auction, merchandise consigned to him for sale by the owners.

His commission on all merchandise sold was 8%. Sometimes he bought merchandise and offered it for sale along with the consigned merchandise. January 1, the only property which he owned was cash, $186.60 deposited in the Merchants National Bank. December 31, of the same year he had the following property; cash in the Merchants National Bank, $3,541.50; merchandise in the store room, $816.65; an automobile which he used in the business, $750; furnishings and equipment in the building where the auction was conducted, $250.50; he owed W. O. Lang, $427.50. What was: (a) his net proprietorship at the end of the year; and (b) the net profit of the business for the year?

PARTNERSHIP

When the title of property, either personal or real, is vested in two or more persons, there is a contract express or implied in regard to the value of the ownership of each person. When the ownership of property used in the operations of a business is vested in two or more persons, the business is operated as a *partnership;* each owner being a *partner* and the contract governing the ownership being known as the *articles of copartnership.* This agreement between the partners should be written, and contain all the information needed to show the interest each partner has in the business.

C. H. Daws owns and operates a grocery store. The value of his net ownership or proprietorship in the business is the difference between his total assets and the total liabilities. In other words, he owns all the property and when his debts are paid, it is subject to his will. J. L. Pickett, one of Mr. Daws' clerks, wishes to become financially interested in the business and buys a one half interest from Mr. Daws. This means that he pays Mr. Daws an agreed amount, which gives him a one half interest in the assets of the business. It is quite evident that Mr. Pickett would want a written agreement in regard to his half ownership in the business. When this contract has been signed by both parties, the assets of the business do not belong to Mr. Daws nor to Mr. Pickett, but to both of them in accordance with the agreement. Neither has the right to take his share of the property without the consent of the other, but each has an agreed right in the property. In other words, neither Mr. Daws nor Mr. Pickett could do as he wills with the property, the interest of each being subject to the will of both.

EXERCISE No. 228, PARTNERSHIP

The following problems provide written practice in ascertaining the proprietorship of two or more partners in a business.

When a Balance Sheet is required, it should be prepared in the same form as the Balance Sheet for the sole proprietor.

1. Thomas Larkin and William Martin formed a partnership on January 2, for the purpose of operating a retail hat store. Mr. Larkin invested $3,000 and Mr. Martin, $2,000. The agreement provided that the profits or losses were to be shared equally. December 31 of the same year, the total assets of the business, consisting of cash, merchandise, and other property were $7,861.65, and the total liabilities were $1,287.95. Each partner desires to know his proprietorship in the net assets of the business based on the agreement.

Assets minus liabilities equal proprietorship. Proprietorship at the end of the year, minus proprietorship at the beginning of the year equals net profit. Each partner's investment plus his share of the profit equals his proprietorship in the business.

2. C. H. Youngblood and C. T. Carlett owned two farms as equal partners, profits or losses to be shared equally. January 2, of the current year, the value of the first farm was $12,500 and of the equipment, stock and farm produce thereon, $2,865.55. The value of the second farm was $21,800; and the equipment and produce, $4,871.65. December 31 of the same year, the value of the first farm was $12,500, and the equipment and farm produce, $6,835.50. The value of the second farm was $21,800, and the equipment and produce was $7,651.80. In addition to this there was deposited in the bank to the credit of the partners, $6,421.80. Each partner desires to know (a) his proprietorship at the end of the year, (b) his profit for the year.

3. John Richards and Ray Heizer formed a partnership for operating a bus line between two cities. At the beginning of the year, May 1, Mr. Richards invested $5,000 and Mr. Heizer $4,000. It was agreed that the profit or loss resulting from the operation of the bus line would be shared in proportion to this beginning investment. A Balance Sheet prepared April 30 of the following year, which was the end of the first year of business, showed the following facts: cash, $861.25; bus equipment, $18,000; gasoline and other supplies, $216.50; they owed the Fourth National Bank, $1,000, and the Moryer Motor Bus Manufacturing Company, $8,000, the balance due on busses. (a) What was the net profit or loss resulting from the operation of the busses

during the first year, assuming that no additional investments were made by the partners, and that there were no withdrawals from the investment, and (b) what was the ownership of each partner in the net assets of the business?

4. January 2, W. E. Hunter, Roy Butler and Harry Hill formed a partnership for the purpose of operating a storage garage and repair shop. Each invested $6,000 in cash, the contract providing that the profits or losses resulting from the operation of the business be shared equally. December 31 of the same year, the assets and liabilities of the firm were as follows: cash, $286.25; notes receivable, $150.20; accounts receivable, $424.50; new and used cars in stock, $10,272; office fixtures, $780.25; machinery, $7,500; tools, $550; repair cars for towing in wrecks, $2,850; store room equipment, $825.75; real estate, $8,000; office supplies, $80.22; prepaid insurance, $100; notes payable, $6,000; accounts payable, $3,980.70. Prepaid a Balance Sheet showing the net proprietorship of each partner.

5. C. H. Weaver, R. J. Baker, and W. H. Miner formed a partnership for the purpose of operating a retail clothing business. Mr. Weaver invested $4,000, cash and $8,000 in real estate; Mr. Baker invested $2,200 in two auto trucks and $3,800 in store fixtures; Mr. Miner invested $8,400 in merchandise and $3,600 in cash. At the end of the first year the assets and liabilities of the firm are as follows: cash, $275.80; notes receivable, $500; accounts receivable, $11,840.25; real estate, $8,000; delivery equipment, $5,200; store fixtures, $3,400; merchandise, $15,400, supplies on hand, $153.50; notes payable, $3,500; accounts payable, $2,500. Prepare a balance sheet showing the proprietorship of each partner, the agreement providing that the partners share in the profits $\frac{2}{5}$, $\frac{1}{5}$, and $\frac{2}{5}$ respectively.

6. J. H. Franklin and C. W. Sheller formed a partnership to promote the sale of real estate. Each partner was to receive interest at 6% on the amount of his investment and to be charged interest at 6% on withdrawals, each investing cash as it might be needed in the promotion of the business. April 2, each invested $5,000; May 1, Franklin invested $2,500; June 1, Sheller invested, $3,000; June 15, Franklin withdrew, $1,000; July 1, Sheller invested, $1,500; August 1, Sheller withdrew, $2,000; September 1, Franklin invested, $5,000; September 15, Sheller

invested, $4,000; October 1, each withdrew, $1,000; November 1, Franklin invested, $3,000; January 2, Sheller invested, $3,000; March 1, Franklin withdrew, $1,000. March 31, which was the end of the first business year, the partnership has the following assets and liabilities: cash in the City National Bank, $3,500; a two-apartment building, 1016 Martin Street, $14,500; a four-apartment building, 2716 Allen Street, $26,750; a six-apartment building, 412 Gay Street, $42,500. They owe the following debts: City National Bank, $5,000; Federal Trust Company, $8,000, on the Martin Street property; Federal Trust Company, $16,000, on the Allen Street property; Union Trust Company, $25,000, on the Gay Street property. In addition to this, the firm owes each partner interest on his investment at 6% from the date it made, up to and including March 31, and each partner owes the firm interest on each withdrawal from the time each withdrawal was made up to and including March 31. From the above facts, ascertain the net proprietorship. Compute the time for interest calculations by compound subtraction using 360 days as a year.

7. J. L. Watson and C. H. Bryant began business January 2, with assets of $27,540.60 and liabilities of $16,487.80. At the end of the year they had assets of $35,671.65 and liabilities of $20,218.40. If each partner had an equal interest in the net worth of the business at the beginning of the year, what will be the net interest of each partner at the end of the year if Mr. Watson withdrew $2,000 of his investment on July 1, and is to pay 6% interest on this for six months?

NOTE: Assume that the interest is not included in the assets given, and the profit is shared equally.

8. Robert Graff and his brother, Henry, purchased the Arlington Creamery, March 10 for $23,500. They paid $7,500 cash, Robert paying $5,000 and Henry, $2,500; they assumed a mortgage of $10,000 on the real estate, and contracted to pay the other $6,000 of the purchase price in monthly installments of not less than $500. December 31, of the same year, the condition of the firm was as follows: real estate, $14,500; machinery, $12,500; butter and other produce, $865.56; cash in the Union City National Bank, $1,162; they owe a mortgage of $10,000 on the real estate, plus accrued interest on it for ninety days at 6%; and a note at the Union City National Bank for $1,000. You

are to ascertain: (a) the profit or loss resulting from the operation of the creamery; (b) the interest of each brother in the net assets, Robert receiving two thirds of the profits or bearing two thirds of the losses and Henry, one third.

9. C. L. Moot and A. L. Newman paid $4,500 for the Automobile Tire Service Company and assumed liabilities of $1,500 owed by the former owner; C. L. Moot provided $2,500 of the purchase price and A. L. Newman $2,000 of it. It was agreed that each partner share in the profits or losses in proportion to his beginning investment. January 1, they sold the business for $6,500, and the purchaser assumed liabilities of $2,000. The partnership was to be dissolved and the cash divided between the partners in accordance with the agreement. Mr. Moot withdrew $500 September 1, and is to pay interest at 6% on this withdrawal from September 1 to date of settlement. How much did each partner receive at the time of settlement, January 10?

10. W. H. Downs and John Darner, two certified public accountants formed a partnership July 1, for the purpose of doing public accounting. Each invested $1,000 in cash to provide funds for office equipment and to employ junior accountants. It was agreed that each partner receive four fifths of the fees resulting from the work which he supervised, the other one fifth to be reserved as partnership property to be shared equally. All accounting work done by the firm was to be supervised by one of the partners. During the first year the fees resulting from the work supervised by Mr. Downs was $32,560, and by Mr. Darner, $37,480.25. Mr. Downs withdrew $18,500, and Mr. Darner $21,400. A Balance Sheet prepared June 30, at the close of the year, showed the net proprietorship as $18,850. What was each partner's interest in the net proprietorship of the business?

CORPORATIONS

When the ownership of a particular property or business is vested in one person, he can control the ownership without considering others. When two or more persons participate in the ownership of property, each must give consideration to the interest of others in the control of the property. A *corporation* is an organization effected for the control of joint ownership of

property. The authority of this joint ownership is granted by the state, this authority being known as the *charter.*

The charter states the amount that may be invested in he business which is to be operated by a corporation. It also states the number of shares into which the capitalization is to be divided and generally places a value on these shares; this is usually $1, $10, $25, $50, or $100. The one who wishes to invest in the corporation purchases one or more of these shares. His interest in the property of the corporation will be determined by the number of shares he owns. If he owns 10 shares and the total number of shares issued is 1,000, his ownership will be $\frac{1}{100}$ of the net proprietorship of the corporation. If the number of shares authorized by the charter is 1,000 but only 900 have been issued, the owner of 10 shares will be entitled to $\frac{10}{900}$ or $\frac{1}{90}$ of the net assets of the corporation.

The one who owns one or more shares of stock in a corporation is known as a *stockholder* and has a proprietary interest in the assets of the corporation, but as in a partnership, he cannot take possession of any part of the corporate property because it belongs to the corporation. However, he has the advantage of the partner in that he can sell his stock to another and thus realize on his investment; a partner cannot sell his interest without the consent of his partner or partners.

A stockholder's interest in the corporation may have two values: (a) one based on the proportionate part of the corporation's net assets; and (b) the price at which it may be sold, known as the *market price.* The value of the stock based on the net value of the corporate property and the market price of the stock may be the same. Stock usually has a value stated in the charter, which is known as the *par value.* If the par value of each share of stock is not stated in the charter, it is known as *no par value stock.*

One should not purchase stock in a corporation, unless he knows the true relation of the par value to the net proprietorship value and the market value. The net proprietorship value, usually referred to as the *book value,* can be determined only from the Balance Sheet of the Corporation, which shows the net asset value of all the property owned by the corporation. This is true whether the stock has a par value, or is "no par value stock". The market value is usually determined by the net profit made by the corporation and the amount of this profit distributed as dividends.

EXERCISE No. 229, CORPORATIONS

The book value of the stock owned by a stockholder in a corporation is determined from (a) the Balance Sheet of the corporation, (b) the number of shares of stock outstanding, and (c) the number of shares owned by the stockholder. It is necessary to know the number of shares outstanding and the number of shares owned by the stockholder, because his interest in the net assets of the corporation is determined by multiplying the net assets by a fraction in which the total number of shares of stock issued is the denominator, and the number of shares owned by the stockholder is the numerator.

The net assets of the Sturm Manufacturing Company are $37,500. This corporation has issued 2,500 shares of stock at $10 per share. M. A. Sulser owns 100 of these shares. His net proprietorship in the corporation is $\frac{100}{2500}$ or $\frac{1}{25}$ of $37,500 which is $1,500.

The following problems provide written practice in determining the book value of a stockholder's proprietorship in a corporation. You are to show on tablet paper all of your calculations necessary to provide the desired information. Prepare a Balance Sheet showing the net proprietorship when various assets and liabilities are given.

1. The capital stock of the Acme Manufacturing Company, a corporation which manufactures automobile accessories, is divided into 5,000 shares, each share having a par value of $100. Only 4,000 of these shares have been issued. At the end of the business year, December 31, the total assets of the corporation were $489,627.85, and the total liabilities, $51,462.78. J. C. Dawson owned twenty-seven shares of stock. What was the book value of his ownership?

2. The Mays Drug Company is incorporated with a capital stock of $50,000, represented by 5,000 shares which have all been issued. At the beginning of the business year, July 1, the total assets of the corporation were $87,621.20, with liabilities of $13,429.54. June 30, of the following year, the total assets were $96,482.80, and the liabilities, $16,929.42. W. L. Douglas owned 210 shares of this stock. He wishes to know (a) the book value of his ownership at the beginning of the year, (b) at the end of the year, and (c) the per cent of increase in the value of his interest.

3. C. H. Wrinkler owned seventy-five shares of stock in the O'Day Tool Company, par value $100 per share. He sold them for $9,225. If the total number of shares issued by the corporation were ten thousand, what was the net value of the assets of the corporation based on the selling price of Mr. Wrinkler's stock?

4. The Arnold Drug Company has an authorized capital stock of 8,000 shares. The assets of the firm as shown by the Balance Sheet on May 16 were $38,416.75, and liabilities, $4,962.78. L. B. Walters owned 450 shares. What was the book value of his ownership in the corporation?

5. May 18, Mr. Walters sold the four hundred fifty shares of the Arnold Drug Company stock, which he owned, for $1,875. (a) How much did he receive in excess of the book value ascertained in the solution of problem 4? (b) What was the per cent of this difference based on the book value?

6. The Pickering Automobile Co. has an authorized capital stock of 1,250 shares. On July 31, its assets were $287,562.98, and its liabilities were $96,148.15. C. H. Duncan owned 75 shares of the stock. What was the book value of his stock if 950 of the 1,250 shares had been issued?

7.

W. A. WATSON COMPANY

BALANCE SHEET, DECEMBER 31, 19....

Assets			*Liabilities*		
Cash	10,545	30	Notes Payable	6,500	
Notes Receivable	2,987	20	Accts. Payable	19,751	65
Accts. Receivable	10,787	16	Accrued Int. on Notes Payable	251	50
Merchandise Inventory	40,365	74	Capital Stock	50,000	
Accrued Int. Earned	42	50	Surplus	?	?
Office Equipment	467	85			
Store Fixtures	362	68			
Delivery Equipment	1,844	55			
Buildings	2,550				
Land	1,500				
Goodwill	5,487	65			
Deferred Charges	427	85			
	67,868	48		67,868	48

The assets are shown on the left and the liabilities on the right. The surplus refers to the net value of the assets in excess of the par value of the capital stock outstanding. You are to determine from the facts given: (a) the surplus; (b) the net value of all assets belonging to the corporation, which is the sum of the capital stock and the surplus; and (c) the book value of the stock of L. D. Wheeler, who owned eighty-seven of the one thousand shares of stock outstanding.

8. R. H. Dougherty owned 37 shares of stock in the Atlas Corporation which has 573 shares outstanding. At the end of one business year, the book value of his stock was $4,467.87, at the end of the next year, the liabilities of the corporation were $11,625.94 and the book value of his stock was $4,215.85 (a) what was the net value of the assets of the corporation at the end of the first year, (b) the total assets of the corporation at the end of the second year, (c) what was the per cent of decrease in the book value of Mr. Dougherty's stock?

9. The net assets of the Midfield Manufacturing Company on June 30 were $18,641.55. J. J. Connard owned eighty-three of the two hundred shares of stock outstanding. What was the book value of his stock?

10. The Pierson Manufacturing Company was owned by four stockholders: John Pierson, Mrs. John Pierson, Thomas C. Dower, and Charles Marshland. Mr. Pierson owned five hundred sixty-two shares; Mrs. Pierson, thirteen shares; Mr. Dower, fifty shares; and Mr. Marshland, the remainder of the seven hundred shares outstanding. December 31, the total assets were, $41,263.85, and the liabilities, $13,427.62. (a) You are to determine the book value of the stock owned by each of the stockholders. (b) Show the per cent of ownership of each of the four stockholders.

CHAPTER XXVIII

COMMISSION AND BROKERAGE

A commission merchant is one who sells merchandise for others on consignment. He accepts the merchandise, sells it, and remits to the owner in accordance with the agreement. The owner of consigned merchandise is known as the *consignor*, and the commission merchant to whom it is consigned, as the *consignee*. The agreed rate per cent the consignee is to receive for distributing the merchandise is known as the *commission*. The report of the consignee to the consignor setting forth the disposition of the goods consigned to him is known as an *account sales*.

The tendency in modern business is for the distributor to buy the merchandise which he distributes. However there are certain classes of merchandise which may best be handled on consignment. Cotton, grain, vegetables, and poultry are illustrations of the class of merchandise sometimes handled on consignment. There are firms in nearly all of the large cities who handle merchandise on consignment; they receive the goods, sell them, and remit to the consignor the net proceeds, which is the amount of the sales, less their commission and expenses.

As a student of arithmetic, you are interested only in the mathematical calculations necessary to arrive at the facts in which the consignor and consignee are both interested. You will learn more about consignments in the study of bookkeeping and commercial law.

EXERCISE No. 230, COMMISSION ON CONSIGNMENTS

A *consignment* is a quantity of merchandise owned by one person or firm and sold by another on a commission basis. The title to the consignment remains in the consignor until the consignee has sold it. When a sale has been made, the consignee is then responsible to the consignor for the sale price of the merchandise, less the commission due the consignee and any expenses which the consignee may have incurred in making the sale.

An *account sales* is the business form used by the consignee for reporting to the consignor the sales and the expenses incurred in handling the consignment. The account sales illustrated below shows a record of the various charges and sales made by the Ferguson Commission Company.

July 2, the Ferguson Commission Company paid $48.62, freight on 200 crates of berries, owned by Robert C. Harmon of Bowling Green, to be sold on commission. July 2, they sold 100 crates of the berries at $3.25, and on July 3, they sold 100 crates at $3.20. July 5, they sent Mr. Harmon a check for the net proceeds of the sale of the berries less the freight, drayage at 5c per crate, storage at 5c per crate, and a commission of 10% of the net sales.

Account Sales

Cincinnati, Ohio July 5, 19

M Robert C. Harmon Address Bowling Green, Ky.

Below please find account sales of 200 crates Berries

Sold by Ferguson Commission Co. *Commission Merchant*

Received July 2 191 *and sold for account of* yourselves

DATE	CHARGES	Folio	AMOUNT	DATE	SALES	Folio	AMOUNT
July 2	Freight	C3	48 62	July 2	50 crates at 3.25	S1	162 50
5	Drayage	J1	10	2	50 " " 3.25	S1	162 50
	Returns			3	100 " " 3.20	C2	320
	"						
	Advances						
	"						
5	Storage	J1	10				
	Insurance						
5	Commission	J1	64 50				
5	Net Proceeds	C3	511 88				
			645				645

The following problems provide written practice in ascertaining the net amount due the consignor for merchandise sold. Show on tablet paper (a) the total expenses, (b) the total sales, (c) the commission, and (d) the amount of the check required to pay the net proceeds. Arrange your work as in the illustration.

1. June 5, R. F. Sadler and Company paid $170.54, freight on 300 crates of berries, 200 baskets of green peas, 100 crates of cantaloupes, and 100 crates of tomatoes received from F. A. Allen of Lexington, Kentucky. July 7, they sold 300 crates of

berries at $2.80, 200 baskets of green peas at $1.35, and 100 crates of tomatoes at $1.16. July 8, they sold 100 crates of cantaloupes at $2.30. July 10, they sent Mr. Allen a check for the sale of the produce less the freight, drayage at 5c per crate and basket, storage, 4c and a commission of 10% of the net sales.

2. July 15, the C. C. Seal Company received from Embry Green & Company of Atlanta, Georgia, 200 crates of peaches and 100 baskets of green peas; they gave the L. & N. R. R. a check for $52.64 in payment of the freight on the shipment. July 16, they sold 150 crates of peaches at $2.50, and 72 baskets of green peas at $1.75. July 17, they sold 50 crates of peaches at $2.50, and 28 baskets of green peas at $1.75. What was the amount of the check sent to Embry Green & Company, after deducting 2c for each crate and basket for drayage, 2c storage, and 10% of the net sales as commission.

3. May 8, the Producers Co-Operative Company received from C. A. Carter of Augusta, Georgia, 100 crates of tomatoes, and paid the Southern R. R. $30.85 for freight. May 9, they sold 50 crates at $2.25. May 10, they sold 25 crates at $2.15. May 11, they sold 25 crates at $2.00. May 15, they sent Mr. Carter a check for the sale of the produce less the freight, drayage at 4c per crate, 5c per crate for storage, and 10% of the net sales as commission.

4. July 5, J. N. Richey & Company received from Hubbard & Moore of Denver, 25 crates of peaches and 200 sacks of corn. They gave the C. & C. R. R. $36.80 to pay for the freight charges. July 6, J. N. Richey & Company sold 25 crates of peaches at $2.50. July 7, they sold 200 sacks of corn at $1.75 per sack. July 15, they sent Hubbard & Moore a check for the sale of the produce less the freight, 2c for each sack and crate for drayage, $\frac{3}{4}$c each for storage, and 10% of the net sales as commission.

5. July 12, T. B. Jones paid $162.04, freight on a consignment of 500 crates of tomatoes and 200 crates of cantaloupes from the Consolidated Fruit Company of Savannah. July 12, he sold 400 crates of tomatoes at $2.25, and 100 crates of cantaloupes at $2.00. July 13, he sold 100 crates of tomatoes at $2.15, and 100 crates of cantaloupes at $1.80. July 15, a check was sent to the Consolidated Fruit Company for the sale of the consignment

less the freight, 4c per crate for drayage, 5c per crate for storage and a commission of 10% of the net sales.

6. June 6, the Cordes Commission Company paid $86.06, freight on 200 crates of tomatoes and 300 crates of berries received from H. C. Shafer of Charleston. June 6, they sold 50 crates of tomatoes at $2.00, 125 crates of berries at $2.75. June 7, they sold 150 crates of tomatoes at $1.90, and 175 crates of berries at $2.75. June 10, a check was sent to the Cordes Commission Company for the sale of the tomatoes and berries less the freight, drayage of 5c per crate, storage of 4c per crate, and 10% commission on the net sales.

7. July 29, Long, West & Company received from T. Knoll, Augusta, 200 baskets of peas and 100 baskets of cucumbers. They gave the C. R. S. & P. R. R. a check for $40.52 in payment of the freight. July 29, they sold 100 baskets of peas at $1.65 and 50 baskets of cucumbers at $1.90. July 30, they sold 100 baskets of peas at $1.65 and 50 baskets of cucumbers at $2.00. August 1, a check was mailed to T. Knoll for $434.23 the net proceeds of the consignment after deducting the freight, drayage at 2c per basket, storage at $\frac{3}{4}$c per basket, and the commission on the net sales. What was the rate of commission?

EXERCISE No. 231, BROKERAGE ON SALES

A *merchandise broker* is one who sells merchandise for a manufacturer or jobber. The merchandise broker sells on a commission basis, but does not carry the merchandise in stock. He takes orders and these are filled from a central warehouse or by direct shipment from the factory. The collection is usually made by the factory, but sometimes it is made by the broker.

The compensation of the merchandise broker is an agreed rate per cent of the sales. This is paid to him by the owner of the goods after the sale has been effected. Applying percentage, the sales is the *base*, the per cent of commission, the *rate*, and the broker's income, the *percentage*.

The following problems provide written practice in solving the problems of a merchandise broker. You are to show on tablet paper all the calculations necessary to ascertain the desired facts.

1. During the month of March, C. A. Bates, a merchandise broker, sold the Hannaford Manufacturing Company merchandise

to the value of $11,865.86. He is to have a commission of $2\frac{1}{2}\%$ on his sales. What was the amount of his compensation?

2. July 1, L. C. Riley, a merchandise broker, received a check from the Dailey Manufacturing Company for $187.64, the commission due him for sales of merchandise during June, on a basis of $3\frac{3}{4}\%$ of the net sales. What was the amount of the gross sales if the value of the returned sales was $382.65?

3. W. H. Carter, a merchandise broker, sold merchandise to the amount of $3,781.65 for the Downing Manufacturing Company during the month of May. If the check received for his services was $132.36, what was the rate of his commission?

4. During a certain year D. D. Fields, a merchandise broker, sold merchandise manufactured by the Nassau Manufacturing Company amounting to $12,461.96. During the year the returned sales amounted to $475.81. If Mr. Field's commission was $4\frac{1}{4}\%$ on the net sales, what was his compensation?

5. J. C. Strong, a merchandise broker, received 200 cases of condensed milk from the Peerless Manufacturing Company to be placed in the Central Warehouse. These were sold to various customers at $4.55 per case. Mr. Strong was to receive a commission of $5\frac{1}{2}\%$ on sales, and to be reimbursed for any expenses in handling the milk. His report to the Peerless Manufacturing Company showed the following expenses: delivery to the warehouse, 10c per case; delivery to customers, $12\frac{1}{2}$c per case; storage charges by the warehouse, 9c per case; commission on the sales, $5\frac{1}{2}\%$. What was the amount of the check received by Mr. Strong from the Peerless Manufacturing Company in payment of his commission and expenses?

6. What per cent of profit was made by the Peerless Manufacturing Company on the sale of the condensed milk in problem 5, if the cost of production was $2.87 per case?

7. J. L. Darby, a merchandise broker, sold to the Birch Manufacturing Company 500 cases of canned corn at $2.65 per case. (a) What was his commission on a basis of $5\frac{1}{2}\%$ of net sales, and (b) what would have been his commission if 5 cases were returned for credit?

EXERCISE No. 232, STOCK BROKERS

A stock broker is one who buys or sells corporation stocks through a stock exchange. The commission charged by the broker, usually referred to as *brokerage* is an agreed amount for each share of stock purchased or sold.

Brokerage is sometimes stated as a rate per cent; that is, $\frac{1}{8}\%$ would be $12\frac{1}{2}$c, $\frac{1}{4}\%$ would be 25c, $\frac{1}{2}\%$ would be 50c, etc.

Walter Cole instructed Robert Adair, a stock broker, to purchase for him ten shares of American Locomotive at the current market price. The market price of this stock when purchased was $113\frac{1}{2}$; he received a bill for ten shares at $113.50 per share, or $1,135 plus $2.50, this being the brokerage fee at 25c per share.

The following problems provide written practice in ascertaining the sale or purchase value of stock at a stated market price, and the broker's commission or brokerage for making the sale or purchase. You are to show on tablet paper the calculations necessary to arrive at: (a) the value of the stock, (b) the brokerage; and (c) the amount the purchaser will pay, or the seller will receive from the broker as a result of the transaction.

1. May 3, A. C. Johnson gave his broker an order to purchase twenty-one shares of American Linseed. The broker purchased the stock at $46\frac{7}{8}$ per share and charged 15c per share brokerage. What was the amount of the check Mr. Johnson gave the broker to pay for this purchase?

2. C. J. Arnold gave his broker twenty-five shares of Baldwin Locomotive with instructions to sell. The broker sold this at $126\frac{7}{8}$ and gave him a check for the proceeds less 25c brokerage. What was the amount of the check?

3. J. L. Dodd purchased through his brokers twenty-nine shares of Chandler Motors at $51\frac{5}{8}$; brokerage, $17\frac{1}{2}$c. What was the amount of the check to pay for this stock?

4. T. H. Barton, a broker, sold sixty shares of Crucible Steel at $77\frac{1}{2}$. What was the amount of the check received by his customer, after the brokerage charge of 20c was deducted?

5. A. J. Frank, a broker, purchased the following stock for a customer: 15 shares of General Electric at $315\frac{3}{4}$; brokerage, 40c; 10 shares of General Motors at $129\frac{3}{4}$, brokerage, 25c; 10 shares of General Asphalt at $68\frac{1}{4}$c, brokerage, $17\frac{1}{2}$c; 25 shares of Illinois Central Railroad at $120\frac{1}{8}$, brokerage, 25c; 15 shares of Mont-

gomery Ward at $76\frac{7}{8}$, brokerage, 20c; 10 shares of New York Central Railroad at $129\frac{1}{4}$, brokerage, 25c; 20 shares of American Can at $54\frac{7}{8}$, brokerage, $17\frac{1}{2}$c. What was the amount of the check received from his customer?

6. A. L. Webb instructed his broker to sell 50 shares of Standard Milling, and received a check from the broker for $4,327.50, the proceeds of the sale less 20c brokerage. (a) What was the amount of the brokerage charges, and (b) what was the selling price of the stock per share?

7. R. L. Haskins, a broker, purchased for J. H. Simms, 25 shares of United States Rubber, common at $85\frac{3}{4}$, brokerage, 20c; and 25 shares of United States Rubber, preferred at $108\frac{1}{2}$, brokerage, 25c. What was the amount of the check received from Mr. Simms in payment of this stock?

8. O. D. Carter instructed his broker to sell 125 shares of Union Pacific, and received a check from the broker for $18,659.37 in payment of the stock, less the brokerage of $22\frac{1}{2}$c. At what price was the stock sold per share?

9. A. L. Pease sold through his broker 125 shares of Underwood Typewriter at $61\frac{1}{2}$. How much did he receive from the sale of this stock, the brokerage being $17\frac{1}{2}$c a share?

10. L. W. Singer instructed his broker to sell 75 shares of Chicago and Alton, preferred at $17\frac{3}{4}$, brokerage $12\frac{1}{2}$c. What amount of cash did he receive from his broker for this stock?

11. T. C. Johnson purchased 125 shares of United Fruit at 293 per share, brokerage 35c. How much did he receive from his customer to pay for this stock?

12. During a certain day a brokerage firm bought and sold the stocks listed below; what was the commission on the business transacted during the day?

1,416 shares.....	brokerage $7\frac{1}{2}$c per share
781 shares.....	brokerage $12\frac{1}{2}$c per share
1,645 shares.....	brokerage $17\frac{1}{2}$c per share
942 shares.....	brokerage 20c per share
540 shares.....	brokerage 25c per share
275 shares.....	brokerage 35c per share

EXERCISE No. 233, COMMISSION ON BONDS

Bonds are sold by banks, bond houses, and brokerage firms. The commission is based on the par value of the bonds. Usually the same rate is charged for buying and selling.

James Watson purchased from the First National Bank ten $1,000 Chesapeake and Ohio $4\frac{1}{2}$s at $94\frac{3}{8}$; maturing in ten years; brokerage, $2 per bond. This means that he will pay the bank $9,437.50, plus $20 brokerage, or a total of $9,457.50.

1. May 1, the City National Bank sold the bonds listed below. You are to ascertain (a) the amount of cash received by the bond department for each sale, and (b) the total amount of the bonds sold, and (c) the total brokerage collected by the bond department for the sales made on this day.

a. To J. H. Brown, twenty-five $500 B. & O. R. R. 6s at $106\frac{3}{4}$, brokerage $1 per bond.

b. To Robert Young, ten $1,000 Bethlehem Steel 5s at $95\frac{1}{2}$, brokerage $2 per bond.

c. To Mays Brothers, fifteen $500 Terminal Building 5s at $98\frac{1}{8}$, brokerage $1.60 per bond.

d. To J. H. Sanders, twelve $1,000 Bell Telephone of Pa. 5s at 102, brokerage $2 per bond.

e. To Mrs. Johnson twenty-five $500 C. & N. W. R. R. 5s at 101, brokerage $1.60 per bond.

f. To C. H. Stephens, seven $1,000 C. C. C. & St. L. 6s at $103\frac{3}{8}$, brokerage $2 per bond.

g. To J. H. Long, fifty $1,000 Erie R. R. 4s at $83\frac{7}{8}$, brokerage $1.50 per bond.

h. To W. O. Crosswhite, five $1,000 fourth $4\frac{1}{4}$ Liberty bonds *102–17, brokerage 50c per bond.

i. To E. H. Crabbe, five $1,000 Anaconda Copper 6s at $103\frac{1}{4}$, brokerage $2 per bond.

j. To W. H. Roberts, fifteen $1,000 New England Telephone 5s at $102\frac{7}{8}$, brokerage $2 per bond.

k. To C. C. Duggan, twenty-five $500 North American Cement $6\frac{1}{2}$s at $98\frac{3}{8}$, brokerage $1.60 per bond.

*Quotations on Liberty bonds are in thirty-seconds. 102–17 means $\$102\frac{17}{32}$ for each $100 of the face of the bond.

l. To Mrs. C. H. Crowley, five $1,000 Bethlehem Steel Corporation 6s at 98⅛, brokerage $2 per bond.

m. To O. A. Crandall, ten $1,000 U. S. Treasury 4¼s at 107–26, brokerage $1.25 per bond.

n. To A. H. Craft, thirty-five $1,000 D. R. & G. 5s at 70⅛, brokerage $2 per bond.

o. To O. H. Brown, fifteen $1,000 Anaconda Copper 6s at 105¼, brokerage $2 per bond.

p. To P. E. Gartin twenty-five $1,000 Bell Telephone of Pa. 5s at 102, brokerage $2 per bond.

q. To P. J. Carroll, twenty-five $1,000 Dodge Bros. 6s at 96¾, brokerage $2 per bond.

r. To C. B. Glover, two $1,000 Southern Bell Telephone Company 5s at 102⅜, brokerage $1.50 per bond.

s. To J. L. Dunn, eight $1,000 New Orleans Public Service Ref. 5s A, at 93¼, brokerage $2 per bond.

t. To E. K. Field, fifty-five $1,000 Utah L. & P. at 85¼, brokerage $2 per bond.

EXERCISE No. 234, BUYING AND SELLING ON COMMISSION

The following problems provide written practice in ascertaining the compensation when a purchase or sale of property is made on a commission basis. The amount of the sale or purchase is the base, and the compensation is the result obtained by multiplying the base by the agreed rate per cent. You are to show on tablet paper the desired information in each problem.

1. An auctioneer is to receive 4½% of the sales made at an auction advertised for May 16. The total sales made at the auction were $2,146.85. What was the amount of his commission?

2. The buyer for a cotton mill purchased 50 bales of cotton, total weight, 25,962 pounds, at 21⅞c per pound on a commission basis of 1¾%. What was his commission?

3. A real estate agent works on a commission basis of 2½% of his sales. He sold a house and lot for $9,650. What was the amount of his commission?

4. An attorney collected a note for $2,500 and paid the owner of the note $2,437.50. What was the rate of his commission.

5. O. Thornton, a salesman, receives \$5 a day and commission as follows: 1% of his daily sales between \$100 and \$250, and 2% of all daily sales over \$250. His daily sales record for the week is: \$125.50, \$240.85, \$75.10, \$464.90, \$252.10, and \$720.50. What is Mr. Thornton's salary for the week?

6. R. J. Malcolm sent C. H. Wasson a New York draft for \$10,000 with instructions to buy wheat, but to deduct his commission for buying from the remittance. How many bushels and pounds of wheat would he buy at \$1.03⅞ per bushel if his commission for buying was 1¾%?

7. Russell Mann sent William Dale, a broker, a \$4,000 New York draft with instructions to purchase lumber. His commission was 2½%. How many feet of lumber will he purchase if the price is \$62.40 per M?

8. A farmer received \$597.75 from his agent as the net proceeds on a shipment of eggs. The agent charged 3% commission for selling, and paid \$8.50 expenses. How many dozen eggs were there, if they were sold for 25c per dozen?

9. A commission agent received \$828 with which to buy berries, after deducting his commission of 2½%. If he paid 7½c a box for the berries, how many boxes did he buy?

10. S. R. Stickley placed a claim of \$3,500 in the hands of his attorney for collection. Before collection could be made, the customer went into bankruptcy. The final adjustment of this case in the court resulted in a cash fund of \$23,400 to be distributed to the creditors in payment for claims amounting to \$39,672.40. How much of his claim did Mr. Stickley receive from his attorney, if the attorney's commission was 5% of the amount collected?

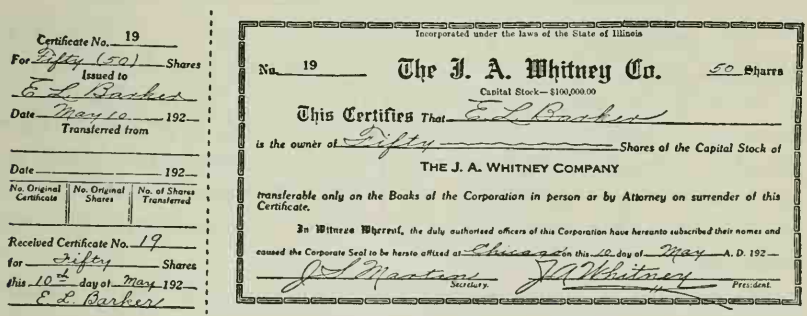
11. Charles Daniels received a check for \$19,500 in payment of a farm. What was the selling price of the farm, if the real estate agent's commission for selling was 2%?

12. Thomas Clark contracted to sell lots Nos. 283, 284, 285, 286, 287, and 288 in a certain subdivision on a commission basis of 3¾%. He sold the lots for the following prices: No. 283 for \$1,250; No. 284 for \$1,300; No. 285 for \$2,130; No. 286 for \$2,275; No. 287 for \$1,150; and No. 288 for \$1,625. What was the amount due Mr. Clark on the day of settlement, if he had previously received \$450 to apply on his commission?

CHAPTER XXIX

STOCKS AND BONDS

The *charter* is the corporation's authority to do business. It states the amount that may be invested in the corporation, and the minimum amount that may be invested by one investor. The maximum amount that may be invested is referred to as the *capital stock*, and the minimum amount that may be invested, by an investor as a *share of stock*. The value of a share of stock designated in the charter is known as its *par value*. The one who owns a share of stock is known as a *stockholder* in the corporation. A stockholder may own more than one share of stock. A stockholder receives a *certificate of stock* from the corporation showing the number of shares of stock he has bought and paid for. The form of certificate is illustrated below.



Certificate No. 19
For Fifty (50) Shares
Issued to
E. L. Barker
Date May 10, 192—
Transferred from

Date 192—

No. Original Certificate	No. Original Shares	No. of Shares Transferred

Received Certificate No. 19
for Fifty Shares
this 10th day of May 192—
E. L. Barker

Incorporated under the laws of the State of Illinois

No. 19 **The J. A. Whitney Co.** 50 Shares

Capital Stock—$100,000.00

This Certifies That E. L. Barker

is the owner of Fifty Shares of the Capital Stock of

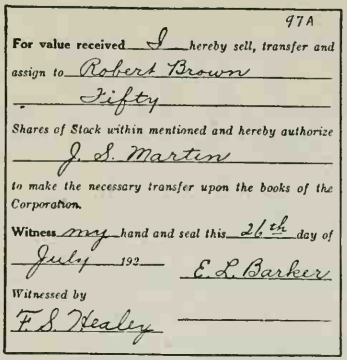
THE J. A. WHITNEY COMPANY

transferable only on the Books of the Corporation in person or by Attorney on surrender of this Certificate.

In Witness Whereof, the duly authorized officers of this Corporation have hereunto subscribed their names and caused the Corporate Seal to be hereto affixed at Chicago this 10 day of May A. D. 192—

J. A. Masters, Secretary. J. A. Whitney, President.

The certificate above shows that E. L. Barker is the owner of fifty shares of the capital stock of The J. A. Whitney Company. The charter has fixed the par value of each share at $100, and 1,000 shares as the maximum amount to be issued. This certificate means that Mr. Barker has a one twentieth interest in the net assets of The J. A. Whitney Company. This certificate does not mean that he can take possession of one twentieth of these assets, but that its value will be determined in this manner.



97A

For value received I hereby sell, transfer and assign to Robert Brown

Fifty

Shares of Stock within mentioned and hereby authorize

J. S. Martin

to make the necessary transfer upon the books of the Corporation.

Witness my hand and seal this 26th day of July 192— E. L. Barker

Witnessed by

F. S. Healey

If Mr. Barker wishes to withdraw as an investor in The J. A. Whitney Company, he has the privilege of selling this certificate. If he does sell one or more shares of his stock, he authorizes the proper officials of the corporation, or its agents to transfer his stock to the purchaser, by filling in the space on the back of the certificate for this authority. The illustration at the left shows the method of authorizing this transfer.

The capital stock of a corporation may be *common* stock, or common stock and *preferred* stock. Preferred stock states the dividend which the holder is to receive; common stock does not state the dividend which the holder is to receive. Dividends are paid on preferred stock before any part of the profit is distributed to the common stockholders as dividend.

The purpose of the discussion here is to provide information necessary for the solution of mathematical problems. You will learn much more about preferred stock, common stock, dividends, and other phases of corporation operations in the study of bookkeeping and commercial law.

The value placed on each certificate of stock by the charter is known as its *par value*. The price which may be obtained for a certificate of stock is known as the *market value*. The value determined from the net assets is known as the *book value*. The *dissolution value* is the stockholder's share in the distribution of the assets of the corporation after it is dissolved and the assets are distributed among the stockholders in proportion to their holdings.

No par value stock has only book value, market value and dissolution value.

A *dividend* is that part of the earnings of a corporation distributed among the stockholders by authority of the board of directors, who are chosen by the stockholders to direct the affairs of the corporation. The dividends are usually a stated per cent of the capital stock or stock outstanding. The capital stock is that authorized by the charter. The outstanding stock is that which has been sold. The owners of the outstanding stock participate in the dividend.

The *surplus* of a corporation is that part of the profit which has not yet been distributed among the stockholders. It is customary not to distribute all the earnings, retaining a part of these as the capital of the corporation. The capital of a corporation is its net assets. If there is a surplus, the capital is the outstanding capital stock plus the surplus; if there is a deficit, the capital is the outstanding capital stock minus the deficit.

ORGANIZATION OF CORPORATIONS

A corporation may be organized to operate a new business or to continue the operations of an established business. The process of organizing a corporation is governed by the laws of the state from which the charter is to be obtained. The required number of persons make application to the proper state officials for a charter. If they have the required capital, the charter will be granted. Each state specifies the value of the property that must be owned by the corporation before the charter is granted. This property is secured by selling the stock in the proposed corporation, or by contract with the former owners of an established business to accept stock in payment for the business. After the charter is granted, the proposed stockholders have a meeting and elect a board of directors, who in turn elect officers in accordance with the by-laws authorized by the charter. When the organization is completed, the stock which has been subscribed and paid for is issued, each stockholder being given a certificate showing the number of shares he owns in the corporation.

Many states have authorized the issuing of "no par value" stock to encourage the prospective purchaser of the stock to investigate its real value before buying the stock. The statement that a certificate of stock has a par value of $100 might be misleading; a statement that a share of stock is only one of a certain number that might be issued by a corporation with no value attached would make it necessary for the proposed purchaser to ascertain its value before buying.

EXERCISE No. 235, ORGANIZATION PROBLEMS

When a corporation is organized either to operate a new business or to continue the operations of an established business, it is necessary to determine the desired amount of capital stock; the par value of each share of stock; also whether the stock is

all to be common, or both common and preferred. This information is determined by the promoters and included in the application for a charter.

The following problems provide oral practice in determining the capital stock to be issued, the par value of the capital stock, and the number of shares of capital stock authorized at the time of organization.

1. The charter of a corporation authorized it to issue capital stock to the value of $100,000 and fixed the par value of each share at $100. How many shares of stock was the corporation authorized to issue?

2. If it is desired that the capital stock of a corporation shall consist of 500 shares, and the par value of each of these shares, $50, what will be the par value of the capital stock of the corporation?

3. It is desired to organize a corporation with a capital of a million dollars, two fifths to be preferred stock and three fifths, common stock, par value of each, $100 a share. How many shares of each kind of stock will the charter authorize?

The par value of the capital stock is not necessarily the amount that the stockholder will pay for it, either at the beginning of the corporation, or at any time thereafter. The promoters of a corporation being formed to operate a business may offer the stock for sale at a discount. If the operations of the corporation have begun, the value of each share of stock will depend upon the value of the assets of the corporation; if the operations are successful, the stock may be worth more than par, but if not successful, it may be worth less than par. These statements are to emphasize the fact that the par value of the capital stock does not always indicate its true value. The one who wishes to buy stock in a corporation should ascertain its true value before making the purchase.

4. It is desired to organize a corporation with no par value common stock. The promoters have $30,000. If the law requires that $25 must be paid in on each share before the corporation may be organized, how much additional cash will they have to obtain before a charter will be granted authorizing the issuing of 2,000 shares of no par value stock?

5. It is desired to organize a corporation with a capital stock of $200,000, one fourth to be preferred and three fourths, common stock, par value, $100 per share. The state law under which the charter is to be granted requires the promoters to have

available one half of the par value of each class of stock before the charter will be granted. What number of shares of preferred and common stock must be sold to produce the required amount in cash, if the preferred stock is sold at par, and the common stock at one half its par value?

6. The number of shares of stock authorized by a corporation is 6,000, and the par value is $25 per share. What is the authorized capital stock?

7. If the authorized capital stock of the corporation referred to in the preceding problem is to be one third preferred and two thirds common, how many shares of each class of stock will the officers of the corporation be authorized to issue?

8. If the state law requires that one half the par value of the authorized capital stock must be paid in before the charter will be granted, how much cash will the stockholders have to pay in if the number of shares authorized is 10,000 and the par value of each share is $25?

9. A corporation is promoted for the operation of a new business. It is desired to have the charter authorize the issuing of 1,000 shares of preferred stock, par value, $100 and 5,000 shares of common stock, par value, $10. The state law requires that before the charter will be granted a corporation must have available cash or other property equivalent to one half the par value of the preferred, and one half the par value of the common stock. As an inducement to buy the preferred stock in this corporation, the promoters have given one share of common stock with each share of preferred stock purchased. How many shares of preferred stock must be sold at par before the charter will be granted?

10. The number of shares to be authorized by the charter of a corporation is 7,500; 2,500 preferred stock, par value, $100, and 5,000 shares common stock, par value, $50. (a) What will be the authorized capital stock of the corporation? (b) If it is sold at 90% of the par value, and one half of the capital stock at par must be paid in before the charter is granted, how many shares of common and preferred stock must be sold in order to have available the required amount of cash to secure the charter; you may assume that an equal number of common and preferred shares is sold.

EXERCISE No. 236, ORGANIZATION OF A CORPORATION

The charter authorizes the number of shares of stock that may be issued by the corporation and fixes the par value of these shares. The selling price of a share of stock at the time the corporation is organized may be the par value, or any value agreed upon between the promoters and the prospective investors. The fact that stock in a proposed corporation is being offered at less than its par value indicates lack of confidence on the part of the promoters, hence the investor should investigate the reason before buying the stock.

The following statements provide the information needed to ascertain the desired facts concerning the organization of a corporation. You are to show on tablet paper all the calculations necessary to obtain the desired information.

1. James Brown and Robert Duggan have been operating "The Hat Shop" as partners. It is desired to incorporate and continue the operations of the business as a corporation. Frank Hauser, David Allen, and Joseph Duley, employees of the partnership, join the two partners in an application for the charter. The net value of the assets of "The Hat Shop" is $36,216.45, equally owned by the two partners. Each of the three employees agrees to invest $1,000 in the corporation. It is agreed by all that the two partners are to be allowed a discount of 10% from the par value of the stock accepted by them in payment for their interest in the partnership. $216.45 of the assets is to be held for one year as a reserve to protect the corporation against old accounts that may not be collected. The application for the charter requests that the corporation be authorized to issue 500 shares of stock with a par value of $100 per share. It is desired to ascertain (a) the value of the assets at the time the charter is granted which includes the value of the partnership property plus the stock sold to the three employees, (b) the number of shares of stock issued after the charter is granted, and (c) the number of shares remaining to be issued.

2. W. L. Morgan owns two gasoline filling stations. The assets of No. 1 are: cash, $291.65; gasoline and oil, $1,014.70; fixtures and equipment, $1,545; land, $5,200; buildings, $4,800. No. 2, cash, $327.50; oil and gasoline, $941.55; equipment, $1,250; the land and buildings are not owned by him. He desires

to incorporate with a charter which will permit the corporation to issue 2,500 shares of stock, par value of $10 per share. His four associates in the corporation agree that he is to have stock at 90% of its par value for the net assets of the two gasoline stations. Any fractional part of $10 remaining after the stock is issued will be paid to him in cash. You are to ascertain (a) the capital stock of the corporation, (b) the number of shares which Mr. Morgan will receive, and (c) the amount of the cash paid to him.

3. The following Balance Sheet shows the assets, liabilities, and proprietorship of the Roberts Printing Company, owned by L. J. Roberts.

BALANCE SHEET

ROBERTS PRINTING CO., DECEMBER 31, 19....

Assets				
Cash	2,161	90		
Accounts Receivable	1,848	19		
Paper in Stock	3,141	75		
Unfinished Publications in Process	5,216	84		
Machinery and Equipment	12,942	55		
Type	861	50		
Deferred Assets	275	50		
Total Assets			26,448	23
Liabilities				
Notes Payable	1,000			
Accounts Payable	1,218	50		
Total Liabilities			2,218	50
Proprietorship				
L. J. Roberts, Capital			24,229	73

Mr. Roberts decides to incorporate with a capital stock of $50,000 divided into 5,000 shares with a par value of $10 each. Four of his employees join with him in the application for the

charter. Each has subscribed for 50 shares to be paid for at par. Mr. Roberts is to receive stock at par for the net assets, less 10% of the accounts receivable, and less 20% of the machinery. You are to ascertain the number of shares of stock issued to Mr. Roberts; the odd dollars and cents less than one share will be paid to Mr. Roberts in cash.

4. The Jones Shoe Company is incorporated with a capital stock of $25,000, consisting of 500 shares, par value $50 a share. This stock is all owned by the three Jones brothers. "C. H." owns 251 shares, "L. B.", 150 shares, and "O. A.", 99 shares. The Peoples Shoe Company, a competitor, is incorporated with a capital stock of $50,000 consisting of 500 shares at a par value of $100 per share. This stock is owned by L. J. Crawford, 175 shares; O. A. Griffin, 100 shares; G. C. Croft, 65 shares; and B. A. Spencer the remainder. It is desired to combine the two corporations. Application has been made for a charter with authority to issue 750 shares of preferred stock, par value $100 a share, and 7,500 shares common stock, at $10 per share. The new corporation is to accept the assets of the two corporations and to assume all liabilities. The Balance Sheet of the Jones Shoe Company shows total assets $96,982.51 and liabilities of $8,642.95. The Balance Sheet of the Peoples Shoe Company shows assets of $68,547.92 and liabilities of $21,759.36. Each stockholder is to receive one half of the net value of his ownership expressed in one hundred dollar units in preferred stock and the balance expressed in ten dollar units in common stock. It is desired to know the number of shares of common and preferred stock each of the seven stockholders will receive in the new corporation, and the par value of his stock. Each stockholder is to receive cash for any fractional part of his holding which remains after the stock is issued. (a) Ascertain the par value of each stockholder's interest, (b) then find the amount of cash each is to receive.

5. David St. Clair and Joseph Elliott own a franchise to operate a bus line between two cities, and operate bus lines on a partnership basis, St. Clair owning three fifths and Elliott, two fifths. They desire to incorporate and have applied for a charter which will authorize them to issue 5,000 shares of common stock with a par value of $10 per share. Their associates in the application for the charter have agreed that each partner is to re-

ceive stock at par value for 120% of the net asset value of his partnership interest. The Balance Sheet of the partnership shows total assets, $21,415.55, and liabilities, $3,127.54. The state law requires that four fifths of the capital stock be subscribed before the charter will be granted. You are to ascertain (a) the number of shares of stock issued to each partner for his interest in the business as per agreement, one share to be issued for the odd dollars and cents, and (b) to ascertain the number of additional shares it will be necessary to sell in order to have the required number of subscriptions to permit its being granted the charter.

EXERCISE No. 237, DIVIDENDS

The income from an investment in corporation stock is the dividends declared out of the earnings of the corporation. The Board of Directors designates the amount to be paid as a dividend. This is usually a stated rate per cent of the par value, when the stock has a par value, and a stated amount per share, when the stock has no par value. A dividend may be declared and ordered paid immediately, or at such time in the future as the Board of Directors deems advisable.

The corporation has agreed to pay a stated dividend on preferred stock, hence the holders of this stock will receive their dividends first. If the corporation does not earn sufficient profit in any one year to pay the dividend on cumulative preferred stock, this dividend must be paid first out of the profits earned in subsequent years. The holder of non-cumulative, preferred stock receives his contract dividend each year, only when it is earned during the year. The holders of common stock may receive no dividends, or may receive an even greater dividend than the holders of the preferred stock, depending upon the corporation's contract with the holders of the preferred stock, the profit made by the corporation, and the amount of profit distributed as dividends.

The following provide oral practice in the solution of problems applicable to dividends on corporation stock.

1. A. H. Dailey owns 12 shares of stock in The Dailey Manufacturing Company, par value $100 per share. A dividend of 4% is declared by the board of directors and paid. How much will Mr. Dailey receive?

2. January 2, the board of directors of the Olney Manufacturing Company declared a dividend of 3% for the year on the common stock, par value $50. The dividend to be paid

quarterly on March 15, June 15, September 15, and December 15. C. H. Willite owns 25 shares of stock. What will be the amount of the dividend check received by him each quarter?

3. D. A. Spruce owns 10 shares of preferred stock in the Acme Manufacturing Company, par value, $100. The rate of dividend is 7%, payable semi-annually. How much will he receive on each dividend date?

4. A. L. David owns 40 shares of the capital stock of the David Manufacturing Company, par value, $25. The board of directors of this company declared a quarterly dividend of $2\frac{1}{2}\%$ payable April 1, July 1, October 1, and January 2. How much will Mr. David receive on each dividend date?

5. May 1, The Jones Manufacturing Company declared a dividend of 4% on the common stock, par value, $50, and ordered checks mailed to stockholders on May 5. What will be the amount of the check received by A. H. Carey who owns 9 shares of stock?

6. The charter of the Davis Manufacturing Company authorized it to issue 500 shares of common stock, par value, $100. January 2, the secretary of the corporation reported that 495 shares were outstanding. The Board of Directors declared a dividend of 5% on the capital stock to be paid quarterly. How much will D. C. Shaw, the owner of 12 shares of stock, receive each quarter?

7. The charter of the Mason Company authorizes the issue of 15,000 shares of stock at a par value of $10 per share, and 5,000 shares have been issued. At the close of the current business year, the net assets of the corporation were $127,500. At a meeting of the Board of Directors, January 5, following the close of the year, it was decided to declare a cash dividend of 10% and a stock dividend of 100%. D. A. Wells owns 50 shares of the capital stock of this corporation. (a) What was the book value of his stock at the end of the business year, (b) how much cash dividend did he receive, and (c) what per cent of the outstanding stock does he own after the stock dividend is paid?

8. A. C. Lord owns 51% of the capital stock of The Lord Manufacturing Company which has issued 1,000 shares of stock at a par value of $100. The board of directors distributed $5,000 to the stockholders in dividend on April 1. How much did Mr. Lord receive?

9. R. A. Jameson owns 12 shares of the C. P. & A. Railway, authorized capital $1,000,000, par value $100 a share. A dividend was declared on July 1. Mr. Jameson received a check for $30. What was the rate of dividend?

10. Robert Lacey owns one share of stock in the Home Laundry which has an authorized capital stock of $50,000, par value of each share $50. A dividend of 10% of the capital stock was declared on August 1. How much will Mr. Lacey receive?

BUYING AND SELLING STOCKS

One who owns stock in a corporation may have secured it (a) through subscribing for stock at the time the corporation was organized, (b) through purchase after the corporation is organized, or (c) through gift. The owner of stock has the right to sell one or more of his shares. The price of listed stock depends upon the income resulting from the dividends, this being reflected in the quotations on the stock exchange.

A stock exchange is a market where stocks are bought and sold. The purchases and sales are made through brokers who are members of the stock exchange, or who have contract relations with a member of the stock exchange. The broker makes a charge for his service in buying and selling stocks.

Stock in a corporation may be bought for a permanent investment, or for speculation. The purchase may be made by the buyer paying the market price of the stock, or by paying only a part of the market price and the broker paying the balance. When the buyer does not pay the full price, the purchase is said to be "on margin". The better plan is for the purchaser to pay in full for the stock bought.

A corporation maintains a list of its stockholders and a record of the number of shares owned by each. This is necessary in order that dividends may be paid to the registered holders of the stock. The purchaser of stock in a corporation should see that the seller properly endorses the certificate so that he may have it transferred on the books of the corporation, otherwise he will not receive any dividends that are declared. Dividends are paid to the stockholders of record on the date specified by the board of directors when declaring the dividend.

EXERCISE No. 238, BUYING AND SELLING STOCKS

No new principles are involved in the solution of problems resulting from a purchase or a sale of stock. The buyer pays the agreed price, and the seller accepts the agreed price. If the buyer receives more for the stock than the purchase price, he makes a profit. If a dividend is declared during the term of his ownership, this increases his profit. If the buyer sells the stock for less than the purchase price, he suffers a loss. If a dividend is declared during his ownership, this reduces the amount of his loss.

The illustration below shows the method of finding the net profit from the purchase and the sale of eighteen shares of stock, purchased at "115¾" and sold at "118⅝", brokerage in each transaction is 25c per share.

$115\frac{3}{4} = \$115.75$
$18 \times \$115.75 = \$2083.50$
$18 \times .25 = \$4.50$
$\$2083.50 + \$4.50 = \$2088$
$118\frac{5}{8} = \$118.625$
$18 \times \$118.625 = \$2135.25$
$18 \times .25 = \$4.50$
$\$2135.25 - \$4.50 = \$2130.75$
$\$2130.75 - \$2088 = \$42.75$

The quotation "115¾" is equivalent to \$115.75 per share. It is easy to obtain the value of 18 shares at this price. The quotation "118⅝" is equivalent to \$118.625. In this case it is necessary to use the half of a cent, because 18 shares are involved, hence it should not be treated as a whole cent. The difference between the purchase price plus the brokerage for buying, and the selling price less the brokerage for selling, is the net profit.

The following problems provide written practice in ascertaining the buying and the selling prices of stocks. The solution of each problem involves the same principles as the solution of problems in multiplication of decimal fractions.

1. Robert Youtsey, President of the Youtsey Manufacturing Company, wishes to be relieved of some of the details in connection with his duties as president, and appoints James Long as his assistant. Mr. Long does not wish to become connected with the firm without having some financial interest in it, and Mr. Youtsey agrees to sell him thirty-five shares of stock at the present market price, which is \$148 per share. Mr. Long is to pay \$1,000 cash and the balance in monthly installments of \$50, to be deducted from his salary, with no interest. (a) How much is Mr. Long to pay for his stock, and (b) how many months will be required to pay the balance.

2. The Aluminum Company of America, preferred was quoted on the stock exchange at 98⅜. How much did J. W. Brown-

field have to pay his broker for forty-eight shares, brokerage 20c per share?

3. What would be the cost of one hundred twelve shares of American Can stock quoted at $54\frac{7}{8}$, brokerage $17\frac{1}{2}$c per share?

4. Ascertain the value of the stocks owned by A. Littlefield at the prices listed below:

14 shares	Great Northern preferred	$73\frac{5}{8}$
125 shares	American Hide & Leather	$16\frac{1}{8}$
52 shares	Hudson Motor	$119\frac{3}{8}$
27 shares	California Packing	$145\frac{3}{4}$
8 shares	Continental Insurance	$138\frac{1}{8}$
25 shares	Crucible Steel	$98\frac{7}{8}$
48 shares	Dodge Bros. common	$43\frac{1}{4}$
65 shares	Dodge Bros. preferred	$87\frac{3}{8}$
19 shares	Reading 1st preferred	$41\frac{5}{8}$
16 shares	Reading 2d preferred	$40\frac{3}{8}$
5 shares	Remington Typewriter	$119\frac{7}{8}$
22 shares	Underwood Typewriter	$63\frac{5}{8}$
16 shares	Willys-Overland preferred	$98\frac{1}{2}$
14 shares	Yale & Towne	$29\frac{7}{8}$

5. The following statement is quoted from the New York Stock Exchange report at the end of a certain day: "Illinois Central common, sales 3,300 shares; high, $118\frac{3}{8}$; low, $116\frac{1}{4}$". What was the average price for the sale of this stock on that day?

6. James Lawson purchased 5 shares of Chandler Motors common at $45\frac{7}{8}$ and sold it at $48\frac{3}{4}$. How much did he make on this transaction, the brokerage fees being 15c per share on both the purchase and the sale?

7. J. H. Robinson purchased 125 shares of Coca-Cola at $151\frac{7}{8}$ and sold them for $145\frac{1}{8}$. How much did he lose on this transaction, brokerage 25c per share on both the purchase and the sale?

8. The next day J. H. Robinson decided to try Coca-Cola again and bought 225 shares at $145\frac{1}{8}$ and sold it before the day closed at $150\frac{3}{8}$. (a) How much did he make on this transaction,

brokerage 25c on the purchase and the sale? (b) How much did he make or lose on the two transactions? (c) What was the per cent of profit or loss based on the cost?

9. James Martin, one of the stockholders in the Ajax Corporation, purchased 75 shares from another stockholder at $148.75 per share. How much did he pay for this stock, no brokerage involved?

10. If the opening price of a stock on a stock exchange is $98\frac{5}{8}$ and the closing price $90\frac{3}{4}$, (a) how much did the stock decrease in value? (b) What was the per cent of decrease based on the opening price?

11. On a certain day Houston Oil opened on the New York Exchange at 67 and closed at the end of the day at $65\frac{3}{4}$. What was the per cent of decrease?

12. Show on tablet paper all the calculations necessary to verify the following bill rendered by a stock broker to his customer:

J. S. BACHE & Co.,

Chicago, Ill., March 15, 192...

Sold to: M. A. Ellerman

Quantity	Description	Price	Commission	Total
25 shares	Baltimore and Ohio	$90\frac{1}{4}$	$ 5.00	$2,261.25
50	Hudson Motor	$92\frac{7}{8}$	10.00	4,653.75
40	Nat'l Cash Register A	$47\frac{3}{8}$	6.00	1,901.00
20	Anaconda Copper	$44\frac{3}{4}$	3.00	898.00
10	U. S. Steel	$123\frac{1}{2}$	2.50	1,237.50
25	Union Oil of California	$44\frac{5}{8}$	3.75	1,115.62
20	Wright Aero	$23\frac{3}{4}$	2.50	477.50
30	Reading 1st Preferred	$40\frac{1}{4}$	4.50	1,212.00
20	Fox Film A	$65\frac{1}{2}$	3.50	1,313.50
40	U. S. Rubber	$69\frac{3}{8}$	6.00	2,775.00
				$17,845.12

BONDS

A bond is a written evidence of indebtedness resulting from borrowed money. Bonds are issued by governments and private corporations. Bonds issued by governmental units are secured by the property owned by the government itself, and the property

of the people who compose the government. Bonds issued by private corporations are secured by a mortgage on real or personal property belonging to the corporation. A bank or trust company acts as trustee in behalf of the bondholders, that is those who lend the money to the corporation. The bank collects from the corporation and pays the bondholder. If the corporation does not pay the bank, the mortgaged real or personal property is sold, and the funds used to pay the bondholders.

A private corporation issues bonds to secure needed capital. The contract governing the issue of the bonds usually provides for the fund to pay the indebtedness at the maturity of the bonds. Thus, if the bonds are to mature in 20 years, one twentieth of the amount of the bonds is set aside each year, so that at the end of the twentieth year the funds will be available to pay the bonds. This provision may be effected through a trustee by depositing with him the yearly amount necessary to provide a fund with which to pay. the bonds, or by setting aside a reserve on the books of the corporation Governmental units issue bonds to secure funds with which to pay for needed improvements which cannot be paid for out of current taxes. The law authorizing the issuance of the bonds provides for the approval of the majority composing the government and the method of raising funds to pay the bonds at maturity. The usual method is to take out of the taxes collected each year the proportionate part of the bonds which will provide the needed funds at maturity. Thus, if the bond issue is for $100,000 and to be paid in 25 years, $4,000 would be taken out of the tax fund each year and placed in a sinking fund which is in charge of a Board of Trustees. The income resulting from the investment of the funds in the hands of the trustees would reduce the amount of taxes to be set aside each year.

For convenience, the face of each bond is usually $1,000, though it may be any desired amount. Thus, if a corporation wishes to borrow $100,000 and to issue bonds as evidence of the indebtedness, it might issue one hundred bonds of $1,000 each, two hundred bonds of $500 each, or one thousand bonds of $100 each.

The interest on bonds is taken care of through coupons attached to the bond. Thus, a thousand dollar bond maturing in ten years with interest at 5%, payable semi-annually, would have attached to it twenty coupons; each coupon is a contract agreeing to pay $25 on a definite date. The holder of the bond detaches the coupon on the day it is due and presents it to the trustee receiving cash for the amount. Coupons may be deposited in a bank as a check, thus avoiding the holder of the bond having to go to the trustee in order to collect the interest. A registered bond is one which does not have coupons, but is registered with the trustee; the holder of a registered bond will receive a check for the interest when due.

The purpose of an investment in both stocks and bonds is to provide an income. The stockholder of a corporation may be an employee, in which case he will earn an income for his services in addition to the income on his investment. The market value of stock is usually determined by the amount of the dividend received by the holder. The market value of a bond is determined by the rate of interest and the market value of money.

If a stock with a par value of \$100 pays 18% a year dividend and money is worth 6%, the holder of the stock would naturally want at least \$300 for a share, because it is paying interest on \$300. If a bond pays 7% interest and money is worth only 6%, the holder would not want to sell the bond at its face, because he is getting more than market value for his money. However, bonds will not vary in price as much as stocks because there is little variation in the market value of money. On the other hand, the price of a stock might vary widely from time to time due to the dividends paid on it.

EXERCISE No. 239, INVESTMENT IN BONDS

When a bond is purchased for investment and held until maturity, the yearly income from the bond is the interest collected, but the net income on the investment may be more or less depending upon the purchase price. If a bond is purchased at par, the net income is the interest; if a bond is purchased above par, the cost above par must be distributed over the number of years to maturity and the proportionate part of this for each year deducted from the interest received to ascertain the net income; if the bond is purchased below par, the distribution is in the same manner, but the yearly proportion is added to the interest collected each year to ascertain the net income. Net income here refers to the income to be taxed by the federal government. A bond is purchased at a *discount* when the purchase price is less than par, and at a *premium* when the purchase price is above par.

December 2, 1926, James Brown purchased ten \$1,000 bonds of the Baldwin Locomotive 5s, maturing December 1, 1941, at 102¼. 102¼ means that each dollar of par value of the bond cost \$1.02¼ or each \$1,000 bond cost \$1,022.50, hence 10 bonds would cost $10 \times \$1{,}022.50 = \$10{,}225$. These bonds pay 5% interest, payable December 1 and June 1. This means that a \$25 coupon is attached to each bond due on each of these dates during the fifteen years between the date and maturity. Had Mr. Brown secured these ten bonds for the par value of \$10,000, his income each year from the bond investment would be \$500. However, Mr. Brown's yearly income from the bond investment will not be \$500, because he paid \$22.50 on each bond

in excess of its par value. Since it is 15 years before the bonds will mature, $\frac{1}{15}$ of this $22.50 must be deducted from the interest collected each year in order to determine the annual income. $22.50 ÷ 15 = $1.50, the annual distribution. $50 − $1.50 = $48.50, net income each year. 10 × $48.50 = $485.00, the net income from the bonds each year.

May 2, 1927, Mr. Brown purchased ten $1,000 bonds of the Atchison, Topeka, and Santa Fe Railroad 4s, maturing May 1, 1946, at 90½. This means that he paid $905.00 for each $1,000 bond. The annual income on each bond is $40 because the interest rate is 4%. However, Mr. Brown's income on these bonds will be more than $40 because he secured them at less than par. Since they do not mature for 19 years, he will distribute $\frac{1}{19}$ of $95 or $5 over the income for each year. This means that his net income each year on these bonds will be $45. In other words, he secures an income of 4½% on the money invested in these bonds even though the yearly income is only 4%.

The purchase price includes brokerage.

The following problems provide written practice in ascertaining (a) the yearly income in dollars and cents on bond investments, and (b) the rate per cent of income on the investment. The purchase and selling price includes brokerage.

1. July 2, David Unger purchased the following bonds:

25 Virginian Railway 5s at 100¾, par value $100, maturing in eighteen years.

6 Cuba Company 6s at 95½, par value $1,000, maturing in six years.

50 Central Steel 8s at 116⅜, par value $500, maturing in twenty five years.

You are to show on tablet paper all the calculations necessary to ascertain (a) the cost of each class of bonds, (b) the yearly income in dollars and cents on each investment, and (c) the rate per cent of yearly income on each.

2. January 2, A. H. Fall purchased 25 Wabash 1st 5s at 102⅜, par value $1,000, maturing in 25 years, and 50 Wabash 1st 5½s at 100⅞, par value $1,000, maturing in ten years. You are to show on tablet paper (a) the cost price of each class of bonds (b) the yearly income from each in dollars and cents, (c) the rate per cent on each investment, (d) the rate per cent one investment is better than the other.

3. October 2, C. H. Stegal purchased 5 Baldwin Locomotive 6s at 103⅛, par value $1,000, maturing in six years, and 5 Baldwin Locomotive 6s at 105⅜, par value $1,000, maturing in twenty-eight years. You are to show on tablet paper all the calculations

necessary to ascertain (a) the cost of each class of bonds, (b) the yearly income in dollars and cents on the investment, and (c) the rate per cent of income.

4. August 2, C. H. Mooney purchased 50 Sinclair Consolidated 7s at $95\frac{5}{8}$, par value \$500, maturity, thirty-one years. You are to show on tablet paper all the calculations necessary to ascertain (a) the cost of these bonds, (b) the yearly income in dollars and cents, and (c) the rate of income.

5. May 5, C. H. Jackson purchased the following bonds:

10 Central New England 4s at $70\frac{7}{8}$, par value \$500, maturity. eight years.

10 Delaware & Hudson Railway 5s at $102\frac{7}{8}$, par value \$1,000, maturity, sixteen years.

12 Dodge Bros. 6s at $95\frac{7}{8}$, par value \$1,000, maturity, twenty-seven years.

Show all the calculations necessary to determine which of these is the best investment stated as a rate per cent of income.

6. June 2, C. H. Sinton purchased the following bonds:

25 Southern Railway $6\frac{1}{2}$s at $112\frac{1}{2}$, par value \$500, maturing in five years.

12 Trumbull Steel 6s at $96\frac{7}{8}$, par value \$1,000, maturing in thirty-two years.

Which is the better investment based on the rate per cent of income?

7. May 15, Arthur Bareford purchased 5 Murray Body $6\frac{1}{2}$s at $90\frac{7}{8}$, par value \$1,000, maturing in twenty-nine years, and 10 Federal Metals 7s at 93, par value \$1,000, maturing in four years. Which is the better investment based on the rate of income?

EXERCISE No. 240, STOCKS AND BONDS

The net income resulting from the purchase and sale of stocks will depend upon the purchase price, the dividends received, and the selling price. The income resulting from the purchase and sale of bonds will depend upon the purchase price, the interest collected, and the selling price.

The following problems provide additional written practice in ascertaining the net income from the purchase and sale of

stocks and bonds. You are to show on tablet paper all the calculations necessary to obtain the desired information. When investments are compared, the smaller income is used as a basis for making the comparison which should always be stated in a rate per cent.

1. January 2, James Burkhart purchased 10 shares of American Car and Foundry Company 7% preferred stock at $127\frac{3}{8}$, par value \$100, and ten \$500 American Sugar Refining Company 6s at $103\frac{5}{8}$, maturing in fourteen years. On December 31, of the same year he sold the stock for $129\frac{7}{8}$ and the bonds for $102\frac{7}{8}$. During the year he received a 7% dividend on the stock and collected 6% interest on the bonds. Which was the better investment?

NOTE: When brokerage is not mentioned, it is included in the purchase price and the selling price.

2. January 2, J. L. Bauser purchased 25 shares of no par value stock in the Acme Manufacturing Company at $87\frac{7}{8}$. He held this stock for three years and sold it at $112\frac{1}{8}$. The first year he received a dividend of \$5 per share; the second year, \$7 per share; and the third year, a quarterly dividend of \$2 per share. What was his net profit, if the brokerage was 20c per share on the purchase, and on the sale?

3. July 1, L. J. Kline purchased 25 American Type Foundry 6s at $103\frac{7}{8}$, par value \$1,000, maturing in fifteen years. He held these bonds for five years and sold them for $104\frac{3}{8}$. The interest is payable semi-annually. During the time of ownership, he collected ten semi-annual payments of interest. What was the rate per cent on his investment, with brokerage of \$2 per bond on the purchase and on the sale?

4. R. H. Kinkead purchased five \$1,000 U. S. Fourth Liberty $4\frac{1}{4}$s bonds at $102\frac{15}{32}$. He kept these for one year and sold them for $109\frac{29}{32}$, brokerage \$1.25 per bond on the purchase, and on the sale. What was the rate per cent on his investment?

5. A Balance Sheet prepared from the ledger of the Atlas Manufacturing Company on December 31, shows total assets, \$356,421.78, and liabilities, \$26,472.39. What is the book value of each of the 3,000 no par value shares issued and outstanding?

6. How much must be invested in U. S. Second Liberty $4\frac{1}{4}$s at $100\frac{29}{32}$ to produce a monthly income of \$500?

7. How much must be invested in Trumbull Steel 6s at $96\frac{7}{8}$ to produce a yearly income of $10,000?

8. August 1, H. H. Mann purchased 50 shares of Mack Truck common at $123\frac{7}{8}$, and 25 shares of Mack Truck 7% second preferred at $105\frac{5}{8}$, par value of each kind of stock, $100. He retained this stock for 5 years and then sold the common for $132\frac{7}{8}$ and the preferred for $109\frac{1}{8}$. During the first year he received a 6% dividend on the common and 7% dividend on the preferred; the second year, 7% dividend on the common and 7% on the preferred; the third year, 8% on the common and 7% on the preferred; during the fourth year, 6% on the common and 7% on the preferred; and during the fifth year, 9% on the common and 7% on the preferred. Which was the better investment, brokerage 25c per share on the purchase and on the sale?

9. May 6, C. H. Humphrey purchased 25 shares of Packard Motor at $36\frac{3}{8}$, and sold them August 27 for $38\frac{1}{8}$. During the time of ownership a dividend of $2 per share was declared and paid. What was the rate per cent on his investment during the time (actual number of days) of ownership, brokerage 15c per share on the purchase, and on the sale?

10. October 1, J. E. Curtis purchased 35 shares California Packing, par value $100, at $133\frac{7}{8}$. December 20, he sold them for $135\frac{7}{8}$, brokerage 25c per share on the purchase and on the sale. What per cent of interest did he receive on his investment?

CHAPTER XXX

INSURANCE

Insurance is the act of insuring against loss or damage by a contingent event; in other words, it is a compensation received for a loss by the one suffering the loss. Its purpose is protection. The compensation is afforded by companies organized to render this service. All risks to which the human family are subject may be insured. The principal forms of insurance are property insurance, personal insurance, and life insurance.

Property insurance is protection afforded the owner of buildings and personal property. *Personal insurance* is the protection afforded the individual because of loss of earnings in case of accident or sickness. *Life insurance* is the protection afforded the dependents of the insured because of death. The protection afforded by insurance is through a contract entered into by the insured with the insurance company. This contract is known as a *policy*. The policy outlines the protection afforded by the insurance, and the method of securing this protection. In other words, it is a contract and subject to all legal requirements of a contract. The insurance company receives compensation for the service which it renders. This compensation is known as a *premium*. The premium is the amount the insured pays the company for the protection afforded by the policy.

FIRE INSURANCE

Fire insurance refers to the protection afforded the insured because of his ownership or interest in buildings or personal property which may be destroyed by fire. The policy describes the compensation the insured is to receive if the property, a part of which he owns or has an insurable interest in, is destroyed or damaged. The owner of the property may have it insured for any amount, and in as many companies as he desires. However, in case of destruction, it is necessary for him to prove the value of the property destroyed. Since insurance is for protection,

he can collect only the value of the property at the time it was destroyed, irrespective of the amount of insurance. This is clearly set forth in the policy.

The rate of the premium, which is usually a fixed price per hundred or thousand dollars of insurance for each year, is determined by the insurance companies through a board of underwriters. The rate will, of course, depend entirely upon the risk. It is quite evident that a frame building located between two other frame buildings will be a greater risk than a brick building located quite a distance from other buildings. A reinforced concrete building with an asbestos roof will be less risk than a frame building with a shingle or tar-paper roof.

Insurance on buildings or personal property is secured through an agent of the insurance company, whose business it is to authorize the policy to be issued. The agent secures his compensation from the company, the insured paying the rate fixed by the board of underwriters. Each state has provided laws to protect its citizens against imposition on the part of insurance companies who do not have sufficient assets to pay the loss in case of fire. In other words, the insurance company cannot sell insurance in a state until it has complied with the state laws covering the issuance of insurance policies.

Since it is necessary for the owner to prove the amount of his loss because of fire, he should keep with his insurance policy a list of the property insured, a description of the property, the date of purchase, and the cost. With this information, he will experience no difficulty in establishing the amount of his loss, or collecting the insurance. This list should be kept up to date so that it will include only the property destroyed.

Sometimes a deduction is allowed in the rate when the premiums are paid for a period longer than one year. Term insurance refers to a policy covering a period of two or more years; the cost is less than for annual insurance. The rate for term insurance and the class of property to which it is applicable is determined by the Board of Underwriters. Both the insurance company, and the insured have the right to cancel the insurance at any time. The conditions under which this cancellation may be effected are explained in the policy.

EXERCISE No. 241, FIRE INSURANCE

The amount of premium is ascertained by multiplying the value of the property by the rate. Thus, if the rate is $21 per thousand and the value of the property insured is $5,000, the premium is $105.

The following problems provide oral practice in ascertaining the premium when the annual rate and value of the property to be insured are given; the value is given in the first column and the rate in the second.

	Insured Value	Rate per $100		Insured Value	Rate per $100
a.	$3,000	$2.25	*a.*	$9,000	$1.50
b.	2,500	2.20	*b.*	10,000	1.65
c.	4,000	1.65	*c.*	11,000	1.40
d.	5,000	1.25	*d.*	5,000	2.20
e.	8,000	1.60	*e.*	2,500	4.80

EXERCISE No. 242, FIRE INSURANCE

Property is generally insured for an even number of hundred or thousand dollars. When the value is great, the risk is usually divided among several insurance companies. Thus, if a merchant carried $50,000 insurance on his stock of merchandise, it would be better to carry this with ten companies, which would distribute the loss if the stock were destroyed by fire.

The following problems provide written practice in ascertaining: (a) the amount of insurance carried on property; and (b) the premiums paid for this protection. The rate paid on each policy in different companies protecting the same property is always the same, because it is fixed by the board of underwriters, which is supported by the insurance companies.

1. The Brown Publishing Company carries insurance on stock as follows: Company A, policy for $5,000; Company B, policy for $3,000; Company C, policy for $8,000; Company D, policy for $2,500; and Company E, policy for $3,500; the rate being $1.73 per hundred. On furniture and equipment as follows: Company A, $2,500; Company B, $3,500; Company C, $1,500; Company D, $1,250; and Company E, $2,000; the rate being $1.25 per hundred. What is (a) the total amount of insurance carried, and (b) the total premium paid?

2. C. H. Arnold carries insurance on his home amounting to $4,000 and on its contents for $2,500. He paid a premium of $182 which protected the property for five years. However, this was the premium rate for four years. (a) What was the premium rate for one year, and (b) how much did he save by paying for four years in advance?

3. The owners of the Carew Building carry insurance on it as follows: Company A, $18,000; Company B, $15,000; Company C, $22,000; Company D, $16,000; the rate being $1.67 per $100. The contents were insured as follows: Company A, $12,000; Company B, $9,500; Company C, $13,400; and Company D, $8,500; the rate being $1.35 per hundred. What is (a) the total insurance carried and (b) the total premium paid?

4. The American Banking Company insured its banking and office building for $350,000 at a rate of $1.33 per hundred. By paying for two and one half years in advance they secured protection for three years. (a) How much was the premium, and (b) what was the amount saved by paying in advance?

5. The Provident Bank Building was insured as follows: Company A, $24,500; Company B, $19,000; Company C, $25,400; and Company D, $21,500, at a rate of $1.86 per hundred. The furniture and fixtures were insured as follows: Company A, $6,500; Company B, $3,200; Company C, $4,500; Company D, $3,500, at a rate of $1.15 per hundred. (a) What was the total amount of insurance carried, and (b) the total premium paid?

EXERCISE No. 243, ADJUSTMENT OF LOSS

The owner of property may insure it for any desired amount in any number of insurance companies. In case of fire, he can collect only the amount of the loss. Since insurance is for protection in case of loss, the owner of the property should carry only a sufficient amount of insurance to replace the property in case of loss.

The following problems provide oral practice in ascertaining the amount of insurance to be collected when the property value, insurance carried, and adjusted fire loss are known. You are to determine from the facts given in each of the three columns the amount of insurance that may be collected.

	Value	Insurance	Fire Loss
a.	$ 5,000	$ 4,000	$ 2,500
b.	12,000	15,000	Total
c.	7,500	3,000	4,000
d.	9,000	5,000	2,000
e.	2,500	17,500	6,500
f.	17,000	12,000	14,000
g.	6,000	1,000	3,000

EXERCISE No. 244, ADJUSTMENT OF LOSS

When two or more companies have insurance on the same property, each will pay its proportionate part of the loss. Thus, if property is under-insured, the owner can collect only the amount of the loss, each company paying its proportionate share; if property is over-insured, he can collect only the amount of the loss, each company paying its share.

Thomas Downs carries insurance on his home as follows: Company A, policy for \$2,500; Company B, policy for \$1,500; Company C, policy for \$5,000; Company D, policy for \$1,000. The property is damaged by fire, and the adjusted loss is \$1,850. Each company will bear the proportionate part of the loss that the amount of its policy bears to the total amount of the insurance. Thomas Downs carries insurance amounting to \$10,000. The policy of Company A is \$2,500. Since \$2,500 is $\frac{1}{4}$ of \$10,000, the amount of the loss sustained by it would be $\frac{1}{4}$ of \$1,850, \$462.50; Company B, $\frac{3}{20}$ of \$1,850, \$277.50; Company C, $\frac{1}{2}$ of \$1,850, \$925; and Company D, $\frac{1}{10}$ of \$1,850, \$185.

The following problems provide written practice in adjusting fire losses when the facts necessary for an adjustment are known.

1. A fire damaged the stock and fixtures of the Brown Publishing Company, problem 1, Exercise No. 242, and the damage to the stock was adjusted as \$9,621.78, and the damage to the fixtures as \$1,975. What was the amount of the checks received by the Brown Publishing Company from each of the insurance companies?

2. The Carew Building, problem 3, Exercise No. 242, was damaged by fire to the extent of \$2,156.50. How much of this was each company required to pay?

3. The Provident Bank Building, problem 5, Exercise No. 242, was damaged by fire to the extent of \$13,250. How much of this loss did each company pay?

4. J. L. Davis carried insurance on his home and furnishings as follows: Company A, building \$2,500 and furnishings, \$1,000; Company B, building, \$2,500, and furnishings \$1,500; Company C, building, \$2,500 and furnishings, \$2,000; Company D, building, \$5,000, garage, \$1,000 and automobile, \$1,200. A fire destroyed the garage and automobile, and damaged the home and furnishings. This damage was adjusted as \$1,560 on the home, \$721.50 on the furnishings, and a complete loss on the garage and automobile. How much did each company pay?

5. The Day Company carried insurance on a warehouse as follows: Company A, building, $10,000 and contents, $2,500; Company B, building, $5,000 and contents, $5,000; Company C, building, $5,000 and contents, $10,000; Company D, contents, $10,000; Company E, building, $5,000; and Company F, building, $5,000, and contents, $10,000. The building and contents were partially destroyed by fire. In making an adjustment, the loss on the building was fixed at $18,500, and the contents, $31,487.50. How much of this damage did each company pay?

EXERCISE No. 245, COINSURANCE

When a property owner agrees to carry insurance to cover a fixed per cent of the value of the property, it is referred to as *coinsurance*. The required rate per cent of the value is stated in the policy. Coinsurance secures a lower rate and greater protection for the property holder; but requires him to carry the stated rate of the valuation or participate in the loss.

Coinsurance means that the insured is a partner with the insurance company in a loss which occurs if he does not carry the agreed amount of insurance as stated in the policy. As a partner, he will be required to share his part of the loss. The insured is fully protected to the amount of insurance mentioned in the policy, if he has complied with the contract regarding the proportionate part of insurance he will carry on the full value of the stock on hand at the time of the fire. The contract in the policy may require the insured to carry 60%, 70%, 80%, or 90% of the value of the property; it is this rate which is the proportionate part of the insurance referred to as a part of the contract in the policy.

James Harris, a retail merchant, has an insurance policy of $9,000 on his stock with a 90% coinsurance clause. This means that his merchandise is worth $10,000. His stock is damaged by fire. An adjustment shows that he had in stock at the time of the fire, merchandise worth $12,000, and that $2,100 of this stock was destroyed. With the 90% clause, he could not collect the full damage, because the insurance was for less than 90% of the value of the merchandise actually in stock at the time of the fire. The policy required that Mr. Harris carry 90% insurance, hence the amount of insurance should have been for $10,800, instead of $9,000. He will be paid only such a fractional part of his loss as the insurance he carried is to the amount he agreed to carry. This means that the insurance company will pay $\frac{9000}{10800}$ or $\frac{5}{6}$ of the loss. $\frac{5}{6}$ of $2,100, the amount of the damage is $1,750, or the amount Mr. Harris will collect from the insurance company. If the policy had been for $10,800, he would have collected $2,100, the full amount of the loss. It is not always possible for a merchant to know the exact amount of stock in his store, and keep it fully protected by insurance, but if he elects to take advantage of the coinsurance rate, he may expect to share part of the loss himself, if he is underinsured.

The following problems provide oral practice in determining the amount of insurance to be collected when the value of the property, the amount of the insurance, and the fire loss are known, and the policy contains a coinsurance clause.

	Value of Property	Amount of Insurance	Fire Loss	Coinsurance Per cent
a.	$20,000	$18,000	$ 3,000	80%
b.	12,000	9,000	5,000	80%
c.	5,000	3,000	2,000	60%
d.	12,000	9,000	1,500	90%
e.	5,000	4,000	500	80%
f.	6,000	4,000	1,000	60%
g.	20,000	16,000	17,000	60%
h.	5,000	3,000	500	80%
i.	8,000	5,000	250	60%
j.	12,000	10,000	2,000	90%
k.	10,000	8,000	9,000	80%
l.	4,000	3,000	550	60%

EXERCISE No. 246, COINSURANCE

When property is insured in more than one company, each company will pay its share of the loss. The method of adjusting the loss when a number of companies are involved and a coinsurance clause is included in each policy is the same as when only one company is involved. The calculations are based on the value of the property at the time of the fire, the rate per cent of insurance carried, and the value of the property destroyed. When the total loss to be paid by all the insurance companies has been ascertained, this loss is distributed in accordance with the amount of each policy.

Robert McDaniels, a retail merchant, has insurance on his furniture and fixtures as follows: Company A, stock, $2,000 and fixtures, $500; Company B, stock, $3,500 and fixtures, $1,500; Company C, stock, $4,000 and fixtures, $1,000; Company D, stock, $2,500. Each policy has an 80% coinsurance clause. Stock and fixtures were damaged by fire. The adjustment showed the value of stock on hand at the time of the fire to be $20,000 and fixtures, $5,000. The damage to the stock amounted to $3,850, and to the fixtures, $680. The illustration on page 406 shows the method of arriving at the amount each insurance company will pay to compensate Mr. McDaniels for his loss in accordance with the agreement in the policies.

Distribution of Damage to Stock

Value of Stock at Time of Fire		$20,000.00
Required Insurance 80% of $20,000	$16,000.00	
Insurance Carried on Stock	12,000.00	
Insurance Carried by Owner	4,000.00	
Adjusted Fire Damage to Stock		3,850.00
Owner's Part of Loss ($\frac{4}{16}$ or $\frac{1}{4}$ of $3,850)	962.50	
Insurance Companies' Share ($\frac{12}{16}$ or $\frac{3}{4}$ of $3,850)		2,887.50
Company A's Share ($\frac{1}{6}$ of $2,887.50)	481.25	
Company B's Share ($\frac{7}{24}$ of $2,887.50)	842.19	
Company C's Share ($\frac{1}{3}$ of $2,887.50)	962.50	
Company D's Share ($\frac{5}{24}$ of $2,887.50)	601.56	
Total Insurance Paid by Companies		2,887.50

Distribution of Damage to Fixtures

Value of Fixtures at Time of Fire		$ 5,000.00
Required Insurance 80% of $5,000	$4,000.00	
Insurance Carried on Fixtures	3,000.00	
Insurance Carried by Owner	1,000.00	
Adjusted Fire Damage to Fixtures		680.00
Owner's Share of Loss ($\frac{1}{4}$ of $680)	170.00	
Insurance Companies' Share ($\frac{3}{4}$ of $680)		510.00
Company A's share ($\frac{1}{6}$ of $510)	85.00	
Company B's share ($\frac{1}{2}$ of $510)	255.00	
Company C's share ($\frac{1}{3}$ of $510)	170.00	
Total Insurance Paid by Companies		510.00

The following problems provide written practice in distributing fire loss when coinsurance is involved. You are to show on tablet paper the solution of these problems arranged in the same form as in the above illustration.

1. The Albert Day Company carried insurance on stock and fixtures as follows: Company A, stock, $10,000 and fixtures, $2,000; Company B, stock, $8,000 and fixtures, $1,000; Company C, stock, $12,000; Company D, stock, $5,000 and fixtures, $1,000; Company E, stock, $15,000 and fixtures, $3,000. Each policy was issued with a 90% coinsurance clause. The stock and fixtures were damaged by fire. The settlement with the adjuster was on the following facts: stock on hand at the time of the fire, $46,400; stock damaged by the fire, $17,200; fixtures on hand at the time of the fire, $6,500; fixtures damaged, $800. You are to ascertain the amount paid by each company.

2. C. H. Johnson, a retail grocer, carried insurance on his stock and fixtures as follows: Company A, stock, $5,000; Company B, stock, $3,000; Company C, stock, $2,000 and fixtures, $2,500; Company D, fixtures, $500. Each policy had an 80% coinsurance clause. Both stock and fixtures were damaged by fire. The adjustment was based on the following facts: merchandise in stock at the time of the fire, $7,500; damage to stock, $1,827.50; fixtures on hand at the time of the fire, $2,250; damage to fixtures, $375. Ascertain the amount paid by each company.

3. The Wilson Company carried insurance on stock in a warehouse as follows: Company A, $10,000; Company B, $12,000; Company C, $15,000; Company D, $18,000; Company E, $25,000. Each policy had a 90% coinsurance clause. The stock was completely destroyed by fire. An inventory made from the records of the stock in the warehouse showed the value at the time of the fire to be $112,500. You are to ascertain the amount each company was required to pay.

4. The owner of the warehouse referred to in problem 3 carried insurance as follows: Company A, $5,000; Company B, $8,000; Company C, $6,000; Company D, $1,000; Company E, $5,000; Company F, $6,000; Company G, $4,000; Company H, $10,000. None of these policies had a coinsurance clause. The appraised value of the warehouse was $42,500 and the contractor replaced it for that price. How much did each insurance company pay for replacing the warehouse?

5. The Marsh Publishing Company carried insurance on stock and fixtures as follows: Company A, stock, $5,000 and fixtures, $2,500; Company B, stock, $2,000; Company C, stock $7,500 and fixtures, $1,500; Company D, stock, $2,500; Company E, fixtures, $1,500; Company F, stock, $5,000 and fixtures, $2,500; Company G, stock, $3,500 and fixtures, $1,000; Company H, stock, $7,500; Company I, stock, $10,000 and fixtures, $3,000. Each policy contained a 90% coinsurance clause. Damage resulting from a fire was settled by the adjusters on the following basis: merchandise in stock at the time of the fire, $41,500; damage to merchandise, $1,262.50; fixtures in stock at the time of the fire, $11,000; damage to fixtures, $750. How much did each company pay?

LIFE INSURANCE

The purpose of life insurance is for protection. While it may be an investment, it is always a protection. The policy is the contract entered into between the company and the insured. It contains full information regarding the premium, the amount of the insurance, how much is to be paid, etc. The policy provides definite information regarding: (a) cash surrender value, or loan value; (b) paid up value; and (c) extended term insurance. There are many forms of policies issued. The three described below will serve to illustrate these.

An *ordinary life policy* is a plan whereby the insured pays a fixed premium every year throughout his life, or until he has reached the age of ninety-six, when he would receive the full amount of the policy in cash. This plan is adapted to persons who need the maximum of permanent protection at the minimum cost.

A *limited payment life policy* is the same as the ordinary life policy except that the total premiums payable, instead of extending over life, are limited to a term of years, such as ten, twenty, or thirty years. The premiums on the policy are then paid in full, and the amount of the policy is payable at the death of the insured to the one named in the policy as a beneficiary. If no beneficiary is named in the policy, the proceeds are payable to the insured's administrators, executors, or assigns. This plan of insurance is adapted to all classes with whom protection is the chief aim and who desire to pay all premiums during their productive years.

An *endowment policy* is a combination of term insurance and savings. It provides for the payment of the face of the policy upon the death of the insured, during a fixed number of years, and for the payment of the full amount at the end of that term, if the insured is then living. The endowment period may be for any number of years. Thus a policy payable to the insured at the end of twenty years, but to his beneficiary in case of his prior death, is called a *twenty-year endowment.* Endowment policies are often written to mature at certain ages such as, 55, 60, 65, or 70, as a means of protecting the insured during his old age.

The *premium* is the money paid to the insurance company for the protection the insurance provides. The amount of this premium depends upon the age of the insured and the form of

the policy. Premiums may be paid annually, semi-annually, or quarterly. When they are paid semi-annually or quarterly, the annual cost is slightly greater, because of the increased clerical work in recording the premiums received and the loss of interest to the insurance company.

Pages 410, 411, and 412 contain information regarding ordinary life, 20-payment life, and 20-year endowment policies. The annual rate, nature of the policy, cash or loan value, paid up value, and extended term insurance applicable to the policy is made a part of the policy, so the insured may have at all times definite information regarding them.

While the purpose of insurance is to protect those who may be dependent upon the insured, yet it is the desire of the insurance company that each policy have a definite value to the insured. Due to the cost of selling insurance, the majority of insurance companies requires the insured to pay three annual premiums before he may claim any value on the policy. At the end of the third year, which means the day before the fourth premium is payable, the insurance policy has (a) a *cash value*, (b) a *loan value*, (c) a *paid up value*, and (d) an *extended term insurance value*.

The cash value refers to the amount of money the insured receives if he surrenders his policy; the loan value is the amount of money he may borrow from the company on the policy; the paid up value is the amount of paid up insurance the insured may obtain by surrendering the policy; the extended term value is the length of time the policy will continue after the insured has failed to pay a premium. If a policy lapses, the insured can surrender the policy and receive the cash value, or the amount of the policy will be extended for the length of time specified in the policy. When an insurance policy is fully paid up, if the insured does not surrender the policy and receive the cash value, the amount of the insurance continues in force and will be paid to the beneficiary at the death of the insured.

EXERCISE No. 247, LIFE INSURANCE

The following problems provide written practice in solving life insurance problems. These are based on the insurance tables given on pages 410, 411 and 412.

1. T. R. Brownfield, twenty-seven years old, wishes to insure his life for $5,000. What will be the annual premium paid in one

(*Continued on page 413*)

ORDINARY LIFE, $1,000

AGE 25				AGE 26		
An.	S.-A.	Qu.	With	An.	S.-A.	Qu.
$20.55	$10.69	$5.45	Dis. and G. A.	$21.02	$10.93	$5.57
19.15	9.96	5.07	Dis. and T. A.	19.62	10.20	5.20
18.25	9.49	4.84	Dis. Only	18.72	9.73	4.96
16.68	8.67	4.42	No Spec. Ben.	17.10	8.89	4.53

Cash or Loan Value	Paid-Up Value	Extended Term Ins.		End of Policy Year	Cash or Loan Value	Paid-Up Value	Extended Term Ins.	
		Years	Days				Years	Days
$ 12	$ 37	1	188	3	$ 13	$ 38	1	215
21	64	2	248	4	22	66	2	289
30	90	3	330	5	32	93	4	23
40	117	5	73	6	42	120	5	139
50	143	6	198	7	52	147	6	270
61	170	7	328	8	63	174	8	53
71	196	9	112	9	74	201	9	200
82	222	10	256	10	86	227	10	344
93	247	11	350	11	97	252	12	68
104	271	13	59	12	109	276	13	121
116	294	14	90	13	121	301	14	131
128	318	15	76	14	133	325	15	97
140	341	16	17	15	146	348	16	17
153	364	16	273	16	159	372	16	251
166	387	17	126	17	172	395	17	85
179	410	17	301	18	186	418	17	241
193	432	18	79	19	201	440	18	4
207	454	18	185	20	215	462	18	95

AGE 27				AGE 28		
An.	S.-A.	Qu.	With	An.	S.-A.	Qu.
$21.51	$11.19	$5.70	Dis. and G. A.	$22.03	$11.46	$5.84
20.11	10.46	5.33	Dis. and T. A.	20.63	10.73	5.47
19.21	9.99	5.09	Dis. Only.	19.73	10.26	5.23
17.54	9.12	4.65	No Spec. Ben.	18.00	9.36	4.77

Cash or Loan Value	Paid-Up Value	Extended Term Ins.		End of Policy Year	Cash or Loan Value	Paid-Up Value	Extended Term Ins.	
		Years	Days				Years	Days
$ 13	$ 40	1	243	3	$ 14	$ 41	1	272
23	68	2	329	4	24	70	3	11
33	96	4	78	5	35	98	4	133
44	123	5	205	6	46	126	5	270
55	151	6	346	7	57	154	7	59
66	178	8	135	8	69	182	8	213
78	205	9	283	9	81	210	10	0
90	232	11	60	10	93	238	11	128
101	257	12	134	11	106	263	12	187
113	282	13	169	12	118	288	13	202
126	307	14	159	13	131	313	14	171
139	331	15	103	14	144	338	15	94
152	355	16	1	15	158	362	15	332
166	379	16	215	16	172	386	16	167
180	402	17	31	17	187	410	16	326
194	425	17	170	18	202	433	17	89
209	448	17	278	19	217	456	17	182
224	470	17	357	20	233	478	17	249

An.=Annual. Dis. and G. A.=Disability and General Accident.
S.-A.=Semi-Annual. Dis. and T. A.=Disability and travel Accident.
Qu.=Quarterly. No Spec. Ben.=No Special Benefit.

20-PAYMENT LIFE, $1,000

AGE 25					AGE 26				
An.	S.-A.	Qu.	With		An.	S.-A.	Qu.		
$29.87	$15.53	$7.92	Dis. and G. A.		$30.32	$15.77	$8.03		
28.00	14.56	7.42	Dis. and T. A.		28.48	14.81	7.55		
26.80	13.94	7.10	Dis. Only.		27.29	14.19	7.23		
24.84	12.92	6.58	No Spec. Ben.		25.30	13.16	6.70		
Cash or Loan Value	Paid-Up Value	Extended Term Ins.		End of Policy Year	Cash or Loan Value	Paid-Up Value	Extended Term Ins.		
		Years	Days				Years	Days	
$ 28	$ 87	3	248	3	$ 29	$ 88	3	273	
47	141	6	109	4	48	142	6	143	
66	196	9	56	5	68	197	9	95	
68	251	12	80	6	88	252	12	116	
107	306	15	149	7	109	307	15	166	
129	361	18	194	8	132	362	18	169	
151	416	21	144	9	155	417	21	71	
175	471	23	329	10	179	472	23	209	
198	524	25	354	11	202	525	25	195	
222	577	27	282	12	227	578	27	91	
248	630	29	135	13	253	631	28	277	
274	682	30	296	14	280	683	30	55	
301	735	32	67	15	308	736	31	167	
330	788	33	202	16	337	789	32	286	
360	841	35	24	17	368	842	34	96	
390	894	36	321	18	399	894	36	18	
423	947	39	171	19	432	947	38	212	
456	1000	Paid-up		20	466	1000	Paid-up		

AGE 27					AGE 28				
An.	S.-A.	Qu.	With		An.	S.-A.	Qu.		
$30.80	$16.02	$8.16	Dis. and G. A.		$31.29	$16.27	$8.29		
28.98	15.07	7.68	Dis. and T. A.		29.49	15.33	7.81		
27.81	14.46	7.37	Dis. Only.		28.34	14.74	7.51		
25.78	13.41	6.83	No Spec. Ben.		26.28	13.67	6.96		
$ 30	$ 88	3	297	3	$ 31	$ 89	3	321	
49	143	6	176	4	50	144	6	208	
69	198	9	131	5	71	199	9	163	
90	253	12	144	6	92	254	12	167	
112	308	15	170	7	115	310	15	163	
135	363	18	132	8	138	365	18	81	
158	419	20	346	9	162	420	20	248	
183	474	23	79	10	187	475	22	300	
207	526	25	28	11	212	528	24	214	
233	579	26	253	12	238	580	26	51	
259	632	28	54	13	265	633	27	186	
287	684	29	170	14	293	685	28	282	
315	737	30	264	15	322	738	29	359	
345	790	32	8	16	353	790	31	91	
376	842	33	166	17	384	843	32	235	
408	895	35	76	18	417	895	34	132	
441	947	37	253	19	451	947	36	292	
476	1000	Paid-up		20	487	1000	Paid-up		

20-YEAR ENDOWMENT, $1,000

AGE 25			With	AGE 26		
An.	S.-A.	Qu.		An.	S.-A.	Qu.
$45.49	$23.65	$12.05	Dis. and G. A.	$45.62	$23.72	$12.09
44.09	22.93	11.68	Dis. and T. A.	44.22	22.99	11.72
43.19	22.46	11.45	Dis. Only.	43.32	22.53	11.48
42.41	22.05	11.24	No Spec. Ben.	42.50	22.10	11.26

Cash or Loan Values	Pd.-up End. Ins. Values	Ext'd Insurance and Pure End.			End of Policy Year	Cash or Loan Values	Pd.-up End. Ins. Values	Ext'd Insurance and Pure End.		
		Yrs.	Days	End.				Yrs.	Days	End.
$ 80	$137	11	300	...	3	$ 80	$137	11	215	...
119	198	16	0	28	4	118	197	16	0	24
159	257	15	0	112	5	159	256	15	0	109
201	315	14	0	192	6	200	314	14	0	189
244	272	13	0	269	7	244	371	13	0	266
290	428	12	0	343	8	290	427	12	0	340
337	483	11	0	413	9	337	482	11	0	411
387	537	10	0	481	10	386	536	10	0	479
437	588	9	0	544	11	437	587	9	0	542
489	638	8	0	604	12	489	637	8	0	602
544	687	7	0	661	13	544	686	7	0	660
601	735	6	0	716	14	601	734	6	0	715
660	781	5	0	769	15	660	781	5	0	768
722	827	4	0	819	16	722	827	4	0	819
787	872	3	0	868	17	787	872	3	0	867
855	916	2	0	914	18	855	915	2	0	914
926	958	1	0	958	19	926	958	1	0	958
1000	Matured				20	1000	Matured			

AGE 27			With	AGE 28		
An.	S.-A.	Qu.		An.	S.-A.	Qu.
$45.75	$23.79	$12.12	Dis. and G. A.	$45.90	$23.87	$12.16
44.35	23.06	11.75	Dis. and T. A.	44.50	23.14	11.79
43.45	22.59	11.51	Dis. Only.	43.60	22.67	11.55
42.60	22.15	11.29	No Spec. Ben.	42.71	22.21	11.32

$ 80	$136	11	127	...	3	$ 79	$135	11	36	...
118	196	16	0	20	4	118	196	16	0	15
158	255	15	0	105	5	158	255	15	0	100
200	314	14	0	186	6	200	313	14	0	182
244	371	13	0	263	7	243	370	13	0	260
289	427	12	0	338	8	289	426	12	0	335
337	482	11	0	409	9	336	481	11	0	406
386	536	10	0	477	10	386	535	10	0	475
436	587	9	0	540	11	436	586	9	0	538
489	637	8	0	601	12	488	636	8	0	599
543	686	7	0	659	13	543	685	7	0	658
600	734	6	0	714	14	600	733	6	0	713
660	781	5	0	767	15	660	780	5	0	767
722	827	4	0	818	16	722	826	4	0	817
787	871	3	0	867	17	787	871	3	0	866
855	915	2	0	913	18	855	915	2	0	913
926	958	1	0	958	19	926	958	1	0	958
1000	Matured				20	1000	Matured			

(*Exercise No. 247—Continued from page 409*)

amount (a) if he elects to take out an ordinary life policy with no special benefits, (b) an ordinary life policy with disability and general accident, (c) a 20-year life policy with disability and travel accident, or (d) a 20-year endowment policy with disability only?

2. If Mr. Brownfield in problem 1 elects the 20-year endowment policy, what will the premium be, if paid (a) quarterly; and (b) how much extra will he pay during the life of the policy if he elects to pay quarterly instead of annually?

3. How much can Mr. Brownfield borrow on his policy at the end of the fifth year; (b) at the end of the tenth year; (c) how long will the insurance be extended if he discontinues paying the premiums at the end of the twelfth year?

4. A. L. Wallace is twenty-five years old. He wishes to take out insurance for $2,500. What will be the annual premium on, (a) a 20-year life policy with disability only; (b) an ordinary life policy with no special benefit; (c) a 20-payment life policy with disability and general accident?

5. If Mr. Wallace in problem 4 had chosen an ordinary life policy with no special benefit, and discontinued paying the premiums after paying the fifteenth one, how long would the policy be extended?

6. If Mr. Wallace in problem 5 borrowed the full value of his policy at the end of the twelfth year and executed a note due in one year, (a) how much cash did he receive if the insurance company deducted interest at $5\frac{1}{2}\%$ in advance? (b) How much did he owe the insurance company at the maturity of the note, this amount to include the note and the premium due at the beginning of the fourteenth year?

7. If Mr. Wallace in problem 5 had permitted his policy to lapse after paying six annual premiums, (a) what would be the paid up value of his policy; and (b) how many years would the policy be extended?

8. C. H. Dodson, age twenty-seven, secured life insurance for $5,000, in the form of a 20-payment life policy with disability and general accident. (a) What will be the premium if the payments are made annually; (b) semi-annually; (c) quarterly?

9. What will be the cash surrender value of the policy issued to Mr. Dodson, (a) at the end of the eighth year; (b) at the end of the sixteenth year; and (c) at the end of the twentieth year?

10. J. H. Harris, twenty-five years old, purchased an ordinary life policy for $5,000, with a disability only clause. When the fourth annual premium was due, he decided to allow the policy to lapse, and take out a 20-year endowment policy with disability and general accident, for $6,500. (a) How much had he paid on the ordinary life policy at the time he let it lapse, if he had paid the premiums quarterly? (b) What was the amount of the annual premium on the 20-year endowment policy? (c) Mr. Harris died eighteen months after the 20-year endowment policy was issued; how much did his estate collect from the insurance company? (d) How much had Mr. Harris paid the insurance company as premiums?

11. R. A. Dunlap had a policy on the ordinary life plan with no special benefit, issued at the age of twenty-five, for $5,000, and surrendered it for its cash value at the end of twenty years, what was the average net cost per year to him for each $1,000 of his insurance?

12. A. C. Prine had a policy for $1,000 on the 20-payment life plan with no special benefit, issued at the age of twenty-eight, on which he discontinued paying the premiums after the fourteenth year; he had it continued under the extended insurance clause. What was the net cost to him per year for his insurance when the extended insurance period expired?

CHAPTER XXXI

TAXATION

The purpose of taxation is to provide money to pay for the protection and service which the people desire their government to render. Property would have no value unless protected by the government. Police protection, improved streets, highways, public buildings, and public schools are a part of the government service. Protection and service can be rendered by the government at a more reasonable cost than by private enterprises.

In the United States there are two principal sources of taxation: (a) by the Federal Government; and (b) by the State Government. Taxes imposed by the Federal Government are for the maintenance of the activities formulated by the Government at Washington. Taxes levied by the State Governments are for the maintenance of state, county, and municipal governments; incorporated cities have the authority to levy privilege taxes.

The Federal Government secures by taxation the funds with which to promote its activities through (a) the sale of internal revenue stamps; (b) duties or customs levied on foreign goods imported into the country; (c) taxes on incomes; (d) taxes on inheritances; and (e) privilege taxes.

Stamp tax refers to the stamps that must be attached to the container of cigars, cigarettes, tobacco, alcohol, and other articles of merchandise which are taxed by the Federal Government. *Duties* or *customs* refer to an indirect tax levied on merchandise or other personal property imported from other countries into the United States. The tax on foreign merchandise is also referred to as a *tariff*. *Income tax* refers to a fixed rate per cent levied on net taxable income. *Inheritance tax* refers to a levy on the property of a deceased citizen. *Privilege taxes* levied by the Federal Government refer to the charge for licenses granted by the Federal

Government for the sale of designated articles such as cigars, cigarettes, tobacco, alcohol, etc.

The government of each state secures funds for its activities through (a) taxes on personal property owned by citizens of the state; (b) taxes on personal and real property within the state; (c) franchise tax on public service corporations; and (d) service taxes. Some states levy taxes on net incomes, and some incorporated cities have the authority to levy privilege taxes.

Personal property includes merchandise owned by merchants and manufacturers, household furniture, automobiles, and movable property. *Real property* refers to land and improvements erected thereon. *Franchise tax* refers to a privilege tax paid by public corporations such as electric companies, gas companies, railroads, street car companies, etc. *Service taxes* refer to the charge levied for special privileges, such as the operation of a business, the practice of a profession, poll tax, etc.

CUSTOMS OR DUTIES

Taxes on imports are based on the value, weight, measure, or a combination of weight and value. *Ad valorem* duty is a certain per cent of the invoice cost. *Specific duty* is levied according to number, weight, or measure, such as yards, pounds, etc. *Gross weight* is the total weight before an allowance is made for the weight of the container. The deduction allowed for the weight of the containers is known as *tare*. Net weight is gross weight, less tare. The loss resulting from leakage or breakage is deducted before imposing the duty.

A port of entry is a place established for the legal entrance of merchandise passing from one country to another. The *Collector of the Port* is the one in charge of the customs house at any port of entry. The United States is divided into districts with a port of entry in each district. These are located along the coasts and on the Mexican and Canadian borders. A *customs declaration* is a statement of the shipper giving the value and weight of the merchandise shipped, the number of packages, the country in which the merchandise was manufactured, etc. A *bonded warehouse* is a warehouse in which imported merchandise is stored until the duty is paid.

EXERCISE No. 248, CUSTOMS OR DUTIES

If the duty is ad valorem, it means that the percentage assessed is calculated on the net invoice value of the goods. If the duty is specific, it means that the duty is assessed on the price per unit of measurement. Some articles are taxed both ad valorem and specific. This means that the amount of duty must be ascertained by both the percentage of the invoice value, and the rate per unit.

If the net invoice value of a shipment of hose from England to the United States were \$825 and the duty at 30% ad valorem, the consignee would have to pay \$247.50 (\$825 × .30) before he could secure the hose. If he did not appear and claim ownership when the shipment arrived, it would be placed in a bonded warehouse for a limited time, until he called and paid the duty.

If a shipment of cigars weighing 50 pounds has a net invoice value of \$550, and is taxed \$4.50 per pound specific duty, and 25% ad valorem, the duty would be ascertained as follows:

Ad valorem duty equals 25% of \$550, or	\$137.50
Specific duty equals 50 times \$4.50, or	225.00
Ad valorem and specific duty	\$362.50

The following problems provide written practice in ascertaining the duty on imported articles. You are to show on tablet paper all of your calculations necessary to ascertain the desired information.

1. If the duty on butter was $2\frac{1}{2}$c per pound, what was the duty on a shipment of 250 pounds gross, the tare being 25 pounds?

2. A shipment of hose from England was billed at \$1,250. The duty was 30% ad valorem. What did the merchant pay the custom official?

3. Four pieces of marble were delivered in New York from Italy. Each piece measured 3′ x 4′ x $6\frac{1}{2}$′. The duty was 80c per cubic foot. What was the tariff paid?

4. What is the duty at 25% ad valorem on 500 boxes of cigars, 50 in a box, billed at \$45 per thousand? What is the total duty on the five hundred boxes, if the specific duty is \$4.50 per pound, and the cigars weigh 12 pounds to the thousand, net?

5. Twelve horses were delivered in Seattle from Vancouver, B. C. Their declared value was \$125 each. The duty was 10%. What was the cost of each horse, and the cost of the twelve, if delivery charges amounted to \$96?

INCOME TAX

Income tax refers to a tax on net income. The tax rate is a designated per cent of the net income. A tax is levied on incomes by the United States government and some of the state governments. The discussion here relates to the federal income tax levied by authority of congress through a law enacted in 1926.

The 1926 Federal Income Tax law requires each individual to pay $1\frac{1}{2}\%$ of the first $4,000 of net taxable income earned in one year; 3% of the second $4,000; and 5% of all in excess of $8,000. Corporations are required to pay $13\frac{1}{2}\%$ on their net taxable income earned in 1926 and each year thereafter. Each individual is allowed a credit of 25% on his earned income not to exceed $20,000. Each individual whose net taxable income is more than $10,000 is required to pay a surtax which is explained later.

Each taxpayer whether an individual or corporation is required to make an annual report on a form provided by the income tax division of the Treasury Department setting forth the necessary facts to show the amount of his net income and the tax thereon. This report or "income tax return", as it is designated by the income tax department, must include the facts for an entire year of 12 months. If this year begins with January 1 and ends with December 31, it is referred to as a *calendar* year; if it begins at any other time, it is referred to as a *fiscal* year. The taxpayer provides full information regarding his (a) gross income, (b) deductions, (c) credit for personal exemption, and (d) credits for dependents.

Gross income refers to the total earnings of the individual or corporation. *Allowable deductions* refer to those costs incident to earning the income which are allowable by law. *Net income* is the difference between gross income and allowable deductions. Each individual is allowed a *personal exemption* and a credit for *dependents*. A single person is allowed $1,500 as a personal exemption, and one who is married or the head of a family is allowed $3,500. An additional credit of $400 is allowed for each dependent, that is each child under eighteen years of age, or a defective person of any age who is supported by the one claiming the credit. Thus, a married man would be entitled to $3,500 for personal exemption, and if he had two children under eighteen years of age, $800 in addition making a total credit of $4,300. The individual taxpayer does not have to pay taxes on the amount of his personal exemption or that for those dependent upon him. Thus, if a married man with three children under eighteen years of age earns only $4,000 a year, he will have no taxes to pay

because the law exempts $4,700 from taxes, $3,500 for himself and $1,200 for his three dependents.

EXERCISE No. 249, FEDERAL INCOME TAX

The computation of the tax on income requires a knowledge of the law which imposes the tax. The law defines the meaning of gross income and the various deductions which are to be made from this income in order to arrive at the net taxable income. The computation of the tax is a very simple problem if the net income and rates are known because it is only a matter of applying the principles of percentage with the net taxable income as the base and the rate as the percentage. The taxpayer should maintain a record of all income and expenses in order that he may have available the information needed for income tax purposes; without this information, the tax cannot be computed.

During the year for which he wishes to report his income tax Robert Camp, a married man with one child five years old, earned a salary of $5,000 as chief accountant for the Acme Manufacturing Company. In addition to his salary he received from the savings bank $60 as interest on savings. His allowable deductions during the year were, interest paid, $90, and taxes, $45. The method of ascertaining his tax is illustrated below.

Income		
Salary	$5,000.00	
Interest	60.00	
Gross Income		$5,060.00
Deductions		
Interest	90.00	
Taxes	45.00	135.00
Net Income		$4,925.00
Credit for Personal Exemption	$3,500.00	
Credit for Dependent Child	400.00	
Total Exemption		3,900.00
Income Subject to Normal Tax		$1,025.00
Tax on $1,025 at 1½%	$ 15.38	
Less Credit of 25%	3.84	
Tax to be Paid		$11.54

You will observe that the gross income is the sum of the two incomes, that is the salary and interest, and the net income is the difference between the gross income and the total deductions. Under the law Mr. Camp is allowed to deduct from his income the sum of the amount paid for taxes

and interest. As a married man he is allowed a personal exemption of $3,500 and an additional credit of $400 for the dependent child. After deducting the $3,900 credit, his net income is less than $4,000, hence he is required to pay only 1½% on the amount of the taxable income. Since the law allows a credit of 25% of the tax on earned income of $20,000 or less, he is entitled to deduct 25% from the tax and is required to pay only the difference between the full amount of the tax and the 25% deduction.

The following problems provide practice in ascertaining (a) the net taxable income, and (b) the tax to be paid by the taxpayer. The first column contains the gross income and the second the deductions. In addition to this each taxpayer is entitled to his personal exemption and credit for dependents. The fourth column contains the credits; "M" is married, and "S" single; the number after "M" indicates the number of children for whom credits are allowed. Arrange your solution as in the illustration.

		Gross Income	Deductions	Credits	Net Income	Amount of Tax
1.	C. J. Adams	$5,650.00	$ 650.00	M	?	?
2.	A. L. Botts	4,800.00	1,350.00	S	?	?
3.	O. C. Crow	4,965.50	1,235.00	S	?	?
4.	A. H. Day	4,800.00	450.00	M	?	?
5.	B. C. Eckel	4,200.00	50.00	M	?	?
6.	O. R. Field	3,700.00	1,025.00	S	?	?
7.	W. H. Gay	5,000.00	27.75	M1	?	?
8.	B. C. Holm	4,800.00	85.65	M2	?	?
9.	D. D. Imes	4,675.00	235.25	M	?	?
10.	O. V. Joy	4,965.62	37.58	M1	?	?

EXERCISE No. 250, FEDERAL INCOME TAX

The law states that all income up to and including $5,000 is earned income and that taxpayers must distinguish between income and earned income where the income is more than $5,000 and not over $20,000. The law also states that one who derives an income from the operations of a business can claim as earned income only 20% of the profit resulting from operating this business during the taxable year. These comments mean that the taxpayer may get 25% credit on all of his income even though it is more than $5,000 or he may get credit only on that part of his earned income to which the 25% deduction applies.

Robert Brown, a single man with no dependents, submits the following facts for income tax purpose: salary as clerk for the Kroger Brokerage Company, $4,800; commissions on sales for the Kroger Brokerage Company, $765.54; interest on bank deposits, $72.50; profits from sale of stocks, $4,245.27; taxes paid, $42.25; contributions to the church, $100; interest paid, $85.50. The illustration shows the method of arriving at the tax which he will be required to pay.

Income

Salary	$4,800.00	
Commission	765.54	
Interest on Bank Deposits	72.50	
Profits from Sale of Stocks	4,245.27	
Total Income		$9,883.31

Deductions

Taxes paid	$ 42.25	
Contributions	100.00	
Interest Paid	85.50	
Total Deductions		227.75
Net Income		$9,655.56

Computation of Tax

Net Income	$9,655.56	
Less Personal Exemption	1,500.00	
Income Subject to Normal Tax	$8,155.56	
Normal Tax on $4,000 at 1½%	$ 60.00	
Normal Tax on $4,000 at 3%	120.00	
Normal Tax on $155.56 at 5%	7.78	
Total Normal Tax		187.78

Computation of 25% Credit on Earned Income

Earned Income		
Salary	$4,800.00	
Commission	765.54	$5,565.54
Less Personal Exemption		1,500.00
Balance		$4,065.54
Normal Tax on $4,000 at 1½%		60.00
Normal Tax on $65.54 at 3%		1.97
Tax on Earned Net Income		61.97
Credit of 25% of Tax on Earned Net Income		$15.49
Total Tax		$172.29

The first problem for Mr. Brown to solve is to determine his total income; second, the deductions which the law allows; and third, the net income. Having ascertained the net income, the next problem is the amount of taxable income. As a single man, he is allowed $1,500 personal exemption, hence he subtracts this from his net income to arrive at the taxable income. The law requires that he pay 1½% on the first $4,000, 3% on the second $4,000, and 5% on all above $8,000. The law also allows him credit for 25% of the tax on his earned income, and this is deducted from the amount of the tax in order to arrive at the net amount to be paid. The calculations necessary to ascertain the credit because of this 25% on net income are shown below the other calculations. Earned income is the compensation earned by the taxpayer through his personal efforts which may be salary or commission. Since Mr. Brown earned both, he is entitled to the sum as earned income. As he is entitled to a personal exemption of $1,500, this is deducted from the sum of the salary and commission to arrive at the amount subject to normal tax. The tax on earned income is 1½% on the first $4,000, and 3% on the remainder. The sum of these two amounts is the tax on earned net income. The credit is one-fourth of this sum.

The following problems provide written practice in ascertaining the income tax to be paid by a taxpayer. The first column contains the earned income, the second, the total income, and the third, the deductions but not the personal exemptions or credit for dependents; they are to be determined from the statement in the fourth column, "S" indicating single, "M" married, and the figure the number of children. Arrange your work in the same form as the illustration.

		Earned Income	Total Income	Deductions	Exemptions	Net Income	Credit on Earned Income	Tax Paid
1.	A. L. David	$5,625.00	$9,464.50	$750.00	S	?	?	?
2.	J. C. Kern	7,550.00	9,950.00	500.00	S	?	?	?
3.	J. B. May	5,000.00	9,842.31	316.29	M1	?	?	?
4.	J. J. Cox	6,278.91	7,944.36	450.85	S	?	?	?
5.	O. G. Mau	8,462.75	9,962.75		S	?	?	?
6.	J. G. Roe	6,827.42	9,746.38	15.65	M2	?	?	?
7.	M. C. Gay	5,000.00	6,250.75	325.50	S	?	?	?
8.	J. H. Davis	7,256.42	9,845.51	227.18	M2	?	?	?
9.	A. L. Seay	5,425.87	7,962.48	487.50	S	?	?	?
10.	S. A. Simon	8,042.65	9,987.56	315.25	S	?	?	?

EXERCISE No. 251, FEDERAL INCOME TAX

The law requires individuals whose net income is more than $10,000 to pay a surtax; a schedule of the rates applicable to surtax is given below. This surtax is in addition to the 1½% on

the first four thousand, 3% on the second four thousand, and 5% on all net income above eight thousand. The taxpayer is entitled to deduct the credit of 25% on his earned net income from the sum of the normal tax and surtax. The individual taxpayer is not required to pay normal tax on dividends received from domestic corporations, but if the sum obtained after adding the dividends to the net income increases it to more than $10,000, he is required to pay surtax on the excess above $10,000.

Schedule of Surtax

Net Income	Per cent	Net Income	Per cent
From $0 to $10,000 inclusive	0	From $36,000 to $40,000 inclusive	10
From $10,000 to $14,000 inclusive	1	From $40,000 to $44,000 inclusive	11
From $14,000 to $16,000 inclusive	2	From $44,000 to $48,000 inclusive	12
From $16,000 to $18,000 inclusive	3	From $48,000 to $52,000 inclusive	13
From $18,000 to $20,000 inclusive	4	From $52,000 to $56,000 inclusive	14
From $20,000 to $22,000 inclusive	5	From $56,000 to $60,000 inclusive	15
From $22,000 to $24,000 inclusive	6	From $60,000 to $64,000 inclusive	16
From $24,000 to $28,000 inclusive	7	From $64,000 to $70,000 inclusive	17
From $28,000 to $32,000 inclusive	8	From $70,000 to $80,000 inclusive	18
From $32,000 to $36,000 inclusive	9	From $80,000 to $100,000 inclusive	19

Net taxable incomes of more than $100,000 are subject to surtax of 20%.

J. L. Bonser, a married man living with his wife, and two children under 18 years of age, reports the following facts for income tax purpose during one taxable year. Income from salary, $12,000; interest on notes and bank deposits, $625.50; royalties, $155.25; profits from a partnership, $4,265.35; rents on property he owns, $1,500; profit on sale of stocks and bonds, $1,340.15; dividends from domestic corporations, $2,500. During the year he paid interest, $637.85; taxes, $596.40; his garage at his home was destroyed by fire resulting in a loss of $297.50; he lost on account of a bad debt, $150; he contributed to the church and other social organizations, $500. The illustration below shows the method of arriving at the amount of tax Mr. Bonser will be required to pay.

Income

Salary	$12,000.00	
Profit from Business	4,265.35	
Interest on Notes and Bank Deposits	625.50	
Rents and Royalties	1,655.25	
Profit from Sale of Stocks and Bonds	1,340.15	
Dividends	2,500.00	
Total Income		$22,386.25

(*Continued on page 424*)

(*Exercise No. 251—Continued from page 423*)

Deductions

Interest Paid	637.85	
Taxes Paid	596.40	
Fire Loss	297.50	
Bad Debts	150.00	
Contributions	500.00	
Total Deductions		2,181.75
Net Income		20,204.50

Computation of Tax

Net Income		20,204.50	
Less Dividends	$2,500.00		
Personal Exemption	3,500.00		
Credit for Dependents	800.00	6,800.00	
Net Income Subject to Normal Tax		13,404.50	
Normal Tax on $4,000 at 1½%		60.00	
Normal Tax on $4,000 at 3%		120.00	
Normal Tax on $5,404.50 at 5%		270.23	
Total Normal Tax			450.23
Surtax on $4,000 at 1%		40.00	
Surtax on $2,000 at 2%		40.00	
Surtax on $2,000 at 3%		60.00	
Surtax on $2,000 at 4%		80.00	
Surtax on 204.50 at 5%		10.23	
Total Surtax			230.23
Tax on Net Income			680.46

Computation of 25% Credit on Earned Income

Earned Income			
Salary	$12,000.00		
20% of Profit from Business	853.07	$12,853.07	
Less Personal Exemption and Credits		4,300.00	
Balance		8,553.07	
Normal Tax on $4,000 at 1½%		60.00	
Normal Tax on $4,000 at 3%		120.00	
Normal Tax on $553.07 at 5%		27.65	
Surtax on $2,853.07, 1%		28.53	
Tax on Earned Net Income		236.18	
Credit of 25% of tax on earned net income.			59.04
Total Tax			621.42

Mr. Bonser's net income is the difference between his total income and total deductions. From his net income he is entitled to deduct the corporation dividend (the corporation has paid a normal tax on its income) and his credits for personal exemption and dependents. Deducting these he has the income which is subject to normal tax. To this he must add his surtax. The law requires that surtax be calculated on the net income when it is more than $10,000. According to the schedule at the beginning of this exercise, Mr. Bonser will pay surtax of 1% on $4,000, 2% on $2,000, 3% on $2,000, 4% on $2,000, and 5% on $204.50. Having arrived at his tax on net income, both normal and surtax, he then deducts the 25% credit on earned income, the balance being the amount of the tax he will be required to pay. To arrive at this 25% deduction, it is necessary to use both normal and surtax. The basis for the earned income calculation is his salary plus 20% of the income from the partnership. The normal tax is calculated on the earned net income less the sum of his personal exemption and credit for dependents. The surtax is calculated on the excess of earned net income over $10,000.

The following problems provide written practice in ascertaining the amount of tax to be paid by the individual.

1. The income tax of R. A. Safford, a married man living with his wife and five year old child, is to be calculated from the following facts: salary and commission, $12,500; profits from a partnership, $3,380; interest on bank deposits and notes, $956; rents, $2,560; dividends on domestic corporations, $6,525. Deductions: interest paid, $136; taxes, $248; bad debts, $93; contributions, $450. What will be the amount of his quarterly payments?

2. Ascertain the amount of tax to be paid by R. A. Litchfield, a single man with no dependents, from the following facts: salary, $15,000; interest on bank deposits and notes, $2,500; dividends from domestic corporations, $8,125; profit on sales of stocks and bonds, $3,462. Deductions: contributions, $650; taxes, $175.

3. During the taxable year the earnings and allowable deductions of C. H. Simpson, a married man living with his wife, and two children under 18 years of age, were as follows: salary and commission, $16,251.35; profits from a partnership, $4,392.68; interest earned on bank deposits and notes, $744.83; income from rents, $2,150; income from royalties, $3,644.75; profit on sales of stocks and bonds, $4,354.92; dividends from domestic corporations, $12,500. Deductions: interest paid, $1,450; taxes, $627.85; fire loss, $1,500; bad debts, $241.38; contributions, $950. Ascertain (a) the amount of income tax he will be required to pay, and (b) the amount of each quarterly payment.

4. The following facts were submitted for income tax purpose by J. J. Castlebury, a salesman, married and living with his wife, and three children under 18 years of age: gross commissions received from the Standard Manufacturing Company, his employer, $22,465.78; traveling expenses in connection with earning this commission, $2,952.89; received from the Standard Manufacturing Company dividends on the stock of the corporation which he owns, $3,600; profit on sales of stocks and bonds, $527.85. Deductions: interest, $471.65; taxes, $396.42; donations, $650. Ascertain the net amount of tax Mr. Castlebury was required to pay.

Earned income is net salary or commission. Where expenses occur in connection with earning the salary or commission, these expenses must be deducted and the earned net income used as a basis for ascertaining the 25% deduction on earned income.

5. A. J. Blair, a married man living with his wife, and six children all under 18 years of age, submitted the following facts for ascertaining his income tax: salary, $10,000; gross commission, $6,721.56; cost of earning commission, $865.54; interest received on bank deposits and notes, $756.09; profit from sales of stocks and bonds, $1,055.75; income from rents, $1,200. During the taxable year he paid interest, $327.50; taxes, $291.95; contributions, $750. What was the amount of his income tax?

6. A. J. Colter, president of the Colter Manufacturing Company, a married man living with his wife, and four children each under 18 years of age, submitted the following facts for income tax purpose: salary, $25,000; interest on bank deposits and notes, $1,246.59; income from rents, $3,465; profit on sales of stocks and bonds, $5,427.62; dividends received from the Colter Manufacturing Company, $16,500. Deductions: taxes, $927.56; bad debts, $450; contributions, $3,500. How much income tax was he required to pay?

7. A. R. Donaldson, merchandise broker, a married man living with his wife, and two children each under 18 years of age, submitted the following facts for income tax purpose: gross earnings of commissions through the sale of the products of the various companies which he represented, $17,526.48; cost of earning this commission, $1,829.74; salary of Mrs. Donaldson as secretary of a social club, $900; dividends received from domestic corporations, $1,200. Deductions: interest, $651.50;

taxes, $762.91; contributions, $950. What was the amount of his income tax?

When a wife has an income separate from her husband, she may make a separate return, or they may make a joint return. In the solution of this problem you are to make a joint return, but include her salary as income; the credit for personal exemptions and dependents will be the same.

8. Joseph Kern, president of the Kern Manufacturing Company, a married man living with his wife, and six children one of whom is over 18 years of age, submitted the following facts for income tax purpose: salary, $20,000; income from interest, $3,756.42; income from rent, $1,500; profit on sales of stocks and bonds, $1,944.76; income from the sale of real estate, $5,650; income from dividends from stock of the Kern Manufacturing Company, $15,500. Deductions: taxes, $721.50; loss due to the operations of a business in which he was a partner, $7,452.65; contributions, $2,500. What was the amount of his tax?

When real estate which has been in the possession of the seller for more than two years is sold at a profit, the seller has the privilege of regarding it as a profit on capital investment and of paying the tax of $12\frac{1}{2}\%$, or of including it with his other income; when real estate has been owned less than two years, the profit resulting from its sale must be included with the other income. Solve this problem with the profit on the sale of real estate included with the other income, and then show the effect on Mr. Kern's tax if this was omitted from his income, and taxed separately at $12\frac{1}{2}\%$.

9. R. J. Sammit, a single man, reported the following facts for income tax purpose: salary, $10,000; commission, $3,475.27; cost of earning the commission, $235.50; profit on sales of stocks and bonds, $478.32; income from interest on bank deposits and notes, $127.50; income from rent, $2,400; dividends from domestic corporations, $3,600. Deductions: taxes, $814.96; donations, $500; loss because of the operations of a business in which he was a partner, $1,652.97. What was the amount of his net tax?

10. C. A. Norman operated a poultry farm; he was a married man living with his wife, one child, and an invalid mother whom he supported; he reported the following facts for income tax purpose: gross income from farm operations, $28,562.65; cost of operating the farm, $6,075.38; income from rents, $350; interest on bank deposits and notes, $248.25; profit on the operations of a store which he owned, $3,629.42. Paid for state and county taxes, $578.40; interest, $650; loss on account of the operations of a feed store in which he was a partner, $1,835.18; donations, $600. What was the amount of his income tax?

EXERCISE No. 252, FEDERAL INCOME TAX

The law requires a corporation to pay $13\frac{1}{2}\%$ of its net taxable income. This $13\frac{1}{2}\%$ is the normal tax; corporations are not required to pay a surtax. If the profit of a corporation is \$25,000, or less, it is allowed an exemption of \$2,000. If the profit of a corporation is more than \$25,000, all of the income is subject to taxation. Corporations are not allowed to deduct donations.

To ascertain the tax that is paid by a corporation, it is necessary to deduct from the gross income all deductible expenses which are costs applicable to earning the gross income, and multiply this difference, which is the net income, by $.13\frac{1}{2}$.

The following problems provide written practice in ascertaining (a) the net income of a corporation, and (b) the income tax. Copy the figures in the two columns and place the correct figures in the other two columns. When your work is submitted it should be the same as the problems below with the desired information for the columns, and with all the calculations necessary to arrive at this desired information.

	Gross Income	Deductible Expenses	Net Income	Tax Paid
1.	\$ 72,500.00	\$ 36,581.75	?	?
2.	185,516.42	119,981.79	?	?
3.	14,462.50	9,291.98	?	?
4.	65,518.54	55,919.81	?	?
5.	13,716.60	9,918.42	?	?
6.	231,317.55	192,919.78	?	?
7.	19,918.81	15,017.62	?	?
8.	11,111.81	8,976.42	?	?
9.	338,516.42	291,918.99	?	?
10.	15,764.81	13,992.97	?	?

EXERCISE No. 253, PROPERTY TAX

Property tax refers to the tax assessed on the value of real and personal property; this assessment is levied by the state government in which the property is located. The taxable value of real estate is fixed by a tax commission in each taxing district, and of personal property by its owner. The rate is usually stated: (a) in mills ($\frac{1}{10}$ of 1 cent); (b) as a rate per cent; or (c) a fixed amount per hundred or thousand dollars of valuation.

The amount of tax a taxpayer will be required to pay, is ascertained by multiplying the assessed value of his property by the rate. The method of solution is the same as ascertaining the percentage when the base and rate are given.

The taxable valuation on property owned by T. C. Jones is $10,000, and the rate is 19 mills. The amount of tax Mr. Jones will pay is $10,000 times .019, or $190. If the rate were $1.90 per hundred, the amount of the tax would be 100 times $1.90, or $190. If the rate were $19 per thousand, the amount of the tax would be 10 times $19, or $190.

The following problems provide oral practice in ascertaining the amount of tax.

Property	Valuation	Tax Rate
a.	$ 5,000	$21 per thousand
b.	10,000	21 mills
c.	2,000	$1.75 per hundred
d.	1,000	19.2 mills
e.	2,500	$24 per thousand
f.	3,000	$2.50 per hundred
g.	100,000	20 mills
h.	10,000	25 mills
i.	8,000	$2.50 per hundred
j.	25,000	$25 per thousand
k.	14,000	$2.50 per hundred
l.	30,000	31 mills
m.	40,000	18 mills

EXERCISE No. 254, PROPERTY TAX

The following problems provide written practice in ascertaining property tax. You are to show on tablet paper all your calculations necessary to provide the desired information.

Property	Valuation	Tax Rate
1.	$ 7,550	$17.50 per thousand
2.	17,500	$20\frac{3}{4}$ mills
3.	5,575	2.075 mills
4.	26,500	$4.25 per hundred
5.	38,650	$17.25 per thousand
6.	6,850	$21.68 per thousand
7.	7,260	25.25 mills
8.	12,500	$3.75 per hundred
9.	121,500	$15\frac{1}{2}$ mills

EXERCISE No. 255, PROBLEMS IN TAXATION

The following provide additional written practice in solving taxation problems. You will show on tablet paper all the calculations necessary to secure the desired information.

1. The taxable property of a town was assessed at $12,500,000. It was necessary to collect $45,500 to maintain the schools. What was the tax rate in mills and hundredths of mills in order to collect that amount?

2. C. H. Steele, a married man living with his wife, and three children under 18 years of age, submitted the following facts for income tax purpose: income from salary, $7,500; royalties, $2,967.55; profits on sales of stocks and bonds, $1,862.97. During the year he paid $175.50 taxes; $290.65 interest, and his donations were $300. What was the amount of his income tax?

3. The schedule of depreciation applicable to automobiles in a certain taxing district was 30% of the cost price the first year, 50% of the cost price the second year, 70% of the cost price the third year, and 85% of the cost price each year thereafter. March 1, M. A. Adams paid $2,250 for an automobile. (a) At what price did he list it for taxation on April 1 each of the four years it was in his possession. (b) How much was the property tax on that automobile, if the rate the first year were 22.9 mills, the second year, 24.3 mills, the third year, 23.77 mills, and the fourth year, 21.97 mills?

4. The taxpayers in a certain city voted a bond issue of $125,000 to improve the streets. The bonds were to mature in twenty years with interest at $5\frac{3}{4}\%$ per year. The assessed property valuation of the city is $31,250,000. What rate in mills per hundred dollars must be levied on the assessed valuation to pay the annual interest on these bonds?

5. The budget for a certain city required the following expenditures for the public schools:

Text books	$ 3,150
Salaries of teachers	58,628
Salaries of supervisors	8,450
Fuel	6,150
Janitor service	4,800
Repairs and maintenance	3,600

The taxable assessed valuation of real and personal property in this city was $19,558,400. What tax rate per thousand was necessary to provide funds to maintain the schools in accordance with the expenses provided for in the budget?

6. J. K. Gibson owns a lot which is 225 feet by 275 feet. The section of the city in which this lot is located was taxed at a valuation of $11,500 per acre. How much tax did Mr. Gibson pay on this lot if the rate was 22.35 mills?

7. The state, county, and city tax rates in a certain city are as follows: state, 14.17 mills; county, 9.37 mills, and city, 15.64 mills. Robert Doyle, a merchant in this city, owns real property which is on the tax list at a valuation of $37,582, and personal property assessed at $2,960. You are required to ascertain: (a) the total amount of his taxes; and (b) the amount that will be received by the state, county, and city.

8. The state income tax in a certain state is 1% on the first $4,000, 1½% on the second $4,000, 2% on the third $4,000, and 3% on all income above $12,000. Based on these rates, how much income tax will the following individuals be required to pay:

Name	Net Income
a. A. L. Maul	$ 7,500
b. C. H. Duncan	3,200
c. A. B. Miller	22,500
d. C. C. Duggan	29,500
e. A. J. Williams	19,800
f. D. E. Butler	27,600

9. A specific taxing district is set up to provide funds for a boulevard to cost $7,875,960. According to the law, the property owners within the district are to pay three fourths of this amount and the balance is to be paid by the city. Each property owner is to have the privilege of paying his assessment in ten equal installments over a period of ten years with interest at 6%, or to pay the entire installment at the time the assessment is made without interest. If a tax payer elects to pay on the installment basis, the annual installment will be added to his tax payments. C. L. Jenkins owns property in this district which is assessed at $22,500, and fronts ninety feet on the boulevard. The rate of assessment requires him to pay $37.50 per front foot. If he elects to pay on

the installment plan, how much will be added to his tax payment each of the ten years, the interest due at the end of each year being included in the tax?

NOTE: A taxing district similar to that mentioned in this problem may include thousands of taxpayers, and the front foot assessment of each taxpayer may differ according to the location of his property. You can see from the calculations necessary in this problem something of the work required to ascertain the proper distribution of the assessments. When a property owner elects to pay his assessment in ten annual installments, it is necessary to calculate the interest that he will have to pay. It is not necessary to explain this process in detail here, but you can see that with thousands of taxpayers involved and each assessment differing, that the calculations would require the services of many accurate clerks.

10. In a certain city, the franchise privilege granted to a company to operate the street railway system, required the payment annually of one eighth of one per cent of the gross income from fares collected from passengers. During a given year the total income from passenger fares was $1,681,572.55. What was the amount of the franchise tax?

11. In a certain city all employers of more than five persons must pay an occupational tax of $1.00 per person, and all owners of property having basements which extend under the sidewalk must pay a privilege tax of 25c per square foot. The Nesbitt Hardware Company owns its own building and employs 186 persons. The lot on which the building is located at the corner of Main and Tenth Streets fronts 127 feet on Main Street and 264 feet on Tenth Street. The basement extends 6 feet under the sidewalk on both sides. You are to ascertain the amount of the occupational tax this company will have to pay.

CHAPTER XXXII

DENOMINATE NUMBERS

A denominate number is a concrete number which relates to measurement. As explained in Chapter I, practically everything is measured today, and numbers must be used to specify the units of measurement. Standard tables of measurement have been established by law and custom.

We know that length is measured in inches, feet, yards, rods, etc.; weight is measured in ounces, pounds, tons, etc.; capacity is measured in pints, quarts, gallons, etc. The value of a denominate number may be expressed in one term of measurement or a number of terms, depending upon the quantity. Thus, six feet may be expressed as seventy-two inches, and six feet six inches may be expressed as six and one half feet or seventy-eight inches. Three bushels and three pecks may be expressed as fifteen pecks, or three and three fourths bushels. Changing the expression without changing the value is referred to as reducing a denominate number. The tendency in business is to express the measurement in one unit value, using a mixed number if the desired quantity cannot be expressed by an integer. Thus, in business the expression six feet six inches would be six and one half feet; three bushels three pecks would be three and three fourths bushels.

It is not possible to reduce a denominate number without knowing the table of standard measurement applicable to the unit expressed. It would not be possible to change inches to a fraction of a foot, or inches to feet without knowing that twelve inches equal one foot.

MEASURES OF EXTENSION

A line has one dimension; that is, length. A straight line is one whose direction does not change; it is, " the shortest distance between two given points". The following is a standard table of linear measure.

12 inches (in.)	= 1 foot (ft.)	$16\frac{1}{2}$ feet	= 1 rod (rd.)
3 feet	= 1 yard (yd.)	320 rods	= 1 mile (mi.)
$5\frac{1}{2}$ yards	= 1 rod (rd.)	1 mile	= 5280 feet

NOTE: Marine measures are expressed in fathoms (6 feet); long cable lengths (120 fathoms); short cable lengths (100 fathoms); knots (1.15 miles); and leagues (3 knots).

EXERCISE No. 256, MEASURES OF EXTENSION

The following problems provide oral practice in changing the expression of length without changing the length.

Express:

1	2
a. 4 ft. 4 in. in inches	*a.* 48 ft. in yards
b. 4 yd. 2 ft. in feet	*b.* 36 in. in yards
c. 120 in. in feet	*c.* 84 in. in feet
d. 4 rd. in yards	*d.* 2 rd. in feet
e. 5 mi. in rds.	*e.* 11 yd. in rods
f. 1 rd. in inches	*f.* 33 ft. in rods
g. 78 inches in feet	*g.* 24 ft. in yards
h. 72 ft. in yards	*h.* 10,560 ft. in miles
i. 66 yd. in feet	*i.* 66 ft. in rods
j. 72 in. in yards	*j.* 60 in. in feet
k. 18 ft. in yards	*k.* 6 ft. 3 in. in inches
l. $49\frac{1}{2}$ ft. in rods	*l.* 2 yd. 1 ft. in feet

EXERCISE No. 257, MEASURES OF EXTENSION

When the length is expressed in several denominations, to reduce from higher to lower denominations, it is necessary to reduce each unit to the next lower denomination in regular order; to reduce from a lower to higher denomination, it is necessary to reduce each unit to the next higher denomination in regular order. Illustration (a) shows descending reduction, and (b) ascending reduction.

a. rd. yd. ft. in.
5 4 2 6

$5\frac{1}{2}$

$27\frac{1}{2}$

4

$31\frac{1}{2}$ yd.

3

$94\frac{1}{2}$

2

$96\frac{1}{2}$ ft.

12

1158

6

1164 in.

In the solution at the left, 5 rd. 4 yd. 2 ft. 6 in. are reduced to 1164 in. The number of rods, 5, is multiplied by $5\frac{1}{2}$, because there are $5\frac{1}{2}$ yards in a rod. The product, $27\frac{1}{2}$, is added to 4, the number of rods given in the problem. The sum is multiplied by 3, the number of feet in a yard, and 2 is added to the product to ascertain the total number of feet. $96\frac{1}{2}$ is multiplied by 12, the number of inches in a foot, and the product, 1158, added to 6, gives 1164, the total inches in 5 rd. 4 yd. 2 ft. 6 in.

In the illustration at the right, 1,256 inches is reduced to rods. 1,256 is first divided by 12, the number of inches in a foot. The quotient is then divided by 3, the number of feet in a yard. The quotient is divided by $5\frac{1}{2}$, the number of yards in a rod. The answer to the problem is 6 rd. 1 yd. 2 ft. 8 in.

b. 12)1256 inches
3)104, number of ft.—8 in.
$5\frac{1}{2}$)34, number of yd.—2 ft.
6, number of rd.—1 yd.

The following problems provide written practice in changing the expression of length without changing the value.

1. How many feet are there in 8 miles?
2. Express 297 rods in feet.
3. Reduce 3 miles 4 rods and 5 yards to yards.
4. How many inches are there in 2 miles?
5. Express 15 yards 3 feet 4 inches in inches.
6. Reduce 42,240 feet to miles.
7. Reduce 26 rods 2 yards 2 feet to feet.
8. Reduce 5 miles 4 yards 2 feet and 7 inches to inches.
9. Express 9 miles 130 rods 13 feet in feet.
10. Reduce 240 rods 3 yards $2\frac{1}{2}$ feet 8 inches to inches.
11. Reduce one mile to inches.
12. Express 316 rods 11 feet 9 inches in inches.
13. Reduce one rod to inches.
14. How many yards are there in $2\frac{3}{4}$ miles?
15. Express 1 mile, 1 rod, 1 yard and 1 foot in inches.

SURFACE MEASUREMENT

In mathematics a surface is that which has length and breadth, but not thickness. The following table is used in measuring the area of a surface.

144 sq. in.	= 1 sq. ft.	160 sq. rd.	= 1 acre (A.)
9 sq. ft.	= 1 sq. yd.	640 acres	= 1 sq. mi. or section
$30\frac{1}{4}$ sq. yd.	= 1 sq. rd.	36 sq. mi.	= 1 township (twp.)

You will observe that the number of square inches in a square foot is the product of 12 multiplied by 12; one square yard, the product of 3 multiplied by 3; etc.

EXERCISE No. 258, SURFACE MEASUREMENT

The following problems provide oral practice in changing the expression of area without changing the area.

Express:

a. 288 square inches as square feet
b. 36 square feet as square yards
c. 5 square yards as square feet
d. 6 square feet as square inches
e. 18 square feet as square yards
f. 320 square rods as acres
g. 108 square miles as townships
h. 27 square feet as square yards
i. 11 square yards as square feet
j. 432 square inches as square feet
k. 9 square feet as square inches
l. 45 square feet as square yards

EXERCISE No. 259, SURFACE MEASUREMENT

The following problems provide written practice in changing the expression of area without changing the area. Show all your calculations on tablet paper.

Express:

1. 15 square miles in acres
2. 12 townships in acres
3. 120 acres 240 square rods in square yards
4. 28 square yards 16 square feet in square inches
5. 3 sections in square rods
6. 864 square inches in square feet
7. 5200 square yards in square feet
8. 1512 square miles in townships
9. 576 square feet in square yards
10. 46 townships in square miles
11. 40,960 square rods in acres
12. 83,520 square feet in square inches

MEASUREMENT OF VOLUME

The *volume* of a body, or solid, is the space occupied by it. A solid has three dimensions, length, breadth, and thickness. A solid which is bounded by six rectangles is a *rectangular solid*,

and one whose surfaces are squares is a *cube*. The following is the table of measurements of solids.

1728 cubic inches (cu. in.)	= 1 cubic foot (cu. ft.)
27 cubic feet	= 1 cubic yard (cu. yd.)
128 cubic feet	= 1 cord of wood

EXERCISE No. 260, MEASUREMENT OF VOLUME

The following problems provide written practice in changing the expression of volume of a solid without changing the volume. Show all your calculations on tablet paper.

1. How many cubic inches are there in a bar of silver $2\frac{1}{2}$ inches long, 3 inches wide, and 2 inches thick?

2. How many cubic inches are there in a block of granite 3 feet 3 inches by 4 feet 4 inches by 5 feet?

3. At 95c per cubic yard, what will it cost to excavate a basement 22 feet 6 inches by 27 feet by 9 feet deep?

4. How many cubic feet are there in a concrete wall 27 yards long, 8 feet 6 inches high, and 21 inches thick?

5. How much will the water in an iron tank 37 feet 5 inches high and 4 feet 9 inches square weigh, if water weighs 62.5 pounds to the cubic foot?

6. At 97c per cubic foot, how much will it cost to dig a ditch 180 rods long, 5 feet wide, and 4 feet deep?

7. How many cubic inches are there in a bar of gold $14\frac{1}{2}$ inches long, $2\frac{3}{4}$ inches wide, and $1\frac{3}{4}$ inches thick?

8. A marble mill received from the quarry a block of marble 11 feet 6 inches by 4 feet 9 inches by 5 feet 6 inches. This was sawed to make two blocks 4 feet 3 inches by 4 feet 9 inches by 5 feet 6 inches, and 7 feet 3 inches by 4 feet 9 inches by 5 feet 6 inches. You are to ascertain: (a) the number of cubic inches in the original block; (b) the number of cubic inches in each of the two blocks after sawing; and (c) the rate per cent each of the two blocks bears to the original block.

MEASUREMENT OF CAPACITY

The capacity of a vessel or other containing body is the interior volume of its contents. Measures of capacity are used for

measuring grains, seeds, liquids, etc. The following tables show two units of measurement, one applicable to dry measure and the other to liquid measure.

Liquid Measure	Dry Measure
4 gills = 1 pint (pt.)	2 pints = 1 quart
2 pints = 1 quart (qt.)	8 quarts = 1 peck (pk.)
4 quarts = 1 gallon (gal.)	4 pecks = 1 bushel (bu.)
$31\frac{1}{2}$ gallons = 1 barrel	2.75 bushel = 1 barrel
63 gallons = 1 hogshead	2150.42 cu. in. = 1 stricken bu.
$7\frac{1}{2}$ gallons = 1 cubic foot	2747.71 cu. in. = 1 heaped bu.
231 cu. in. = 1 gallon	67.2 cu. in. = 1 dry quart

Dry measure is used for measuring grains, seeds, produce, etc., and liquid measure for measuring all liquids except medicine.

EXERCISE No. 261, MEASUREMENT OF CAPACITY

The following problems provide oral practice in expressing units of measurement applicable to the above tables by changing the expression of the volume of measurement without changing the value.

Express:	1	2
a.	3 gallons in pints	462 cubic inches in gallons
b.	64 pints in bushels	6 bushels in quarts
c.	2 pints in gills	16 gills in pints
d.	8 quarts in pints	24 pints in quarts
e.	16 quarts in pints	32 quarts in pecks
f.	2 bushels in pints	3 bushels in pecks
g.	8 pints in gills	16 pints in pecks
h.	8 pecks in bushels	2 gallons in pints
i.	4 pecks in pints	4 quarts in gills
j.	16 quarts in gills	16 gills in pints
k.	20 pints in gills	24 pints in quarts
l.	3 bushels in pecks	12 quarts in pints

EXERCISE No. 262, MEASUREMENT OF CAPACITY

The following problems provide written practice in expressing units of measurement of capacity. Show all of your calculations on tablet paper.

1. How many gallons are there in 840 pints?

2. How many gills are there in 45 gallons?

3. Find the capacity in gallons of a box 4 feet 6 inches by 2 feet 4 inches by 10 inches. Carry inexact results to two decimal places.

4. A dealer bought 42 gallons of maple syrup at 84c a gallon, and retailed it at 30c a quart. What was his gain, the freight charges being $1.45?

5. How many gallons of water can be stored in a rectangular reservoir 240 feet long, 144 feet wide, and 36 feet deep?

6. Express 30 bushels 3 pecks 7 quarts in pints.

7. A grocer bought 16 barrels of apples at $5.60 a barrel, and retailed them at 55c a peck. What was his profit on the 16 barrels?

8. A bin used for storing grain holds 568 bushels. What is its capacity in barrels?

MEASURES OF WEIGHT

Avoirdupois weight is used in weighing heavy, coarse articles, such as grain, coal, iron, etc. The table of weights is shown below:

Avoirdupois Weight

16 ounces (oz.)	= 1 pound
100 pounds (lb.)	= 1 hundredweight (cwt.)
20 hundredweight	= 1 ton (T.)
2000 pounds	= 1 ton
7000 grains	= 1 pound avoirdupois

A long ton, sometimes referred to as a gross ton, contains 2,240 pounds. It is used by the United States customhouse in determining duty on merchandise taxed by the ton. It is also used when selling coal and iron at wholesale at the mines. Unless a long ton is specified, the weight expressed in tons is 2,000 pounds.

Troy Weight

Troy weight is used when weighing diamonds, gold, silver, and other precious minerals. It is also used by the government for

weighing coins at the mint. The table of weights is given below.

24 grains (gr.)	= 1 pennyweight (pwt.)
20 pennyweights	= 1 ounce (oz.)
12 ounces	= 1 pound (lb.)
5760 grains	= 1 pound troy

Carat (for precious stones) = 205.5 milligrams or 3.168 grains troy. The carat was formerly an ambiguous term having many values in various countries.

Karat (fineness of gold) = $\frac{1}{24}$ (by weight) gold. For example, 24 karats fine equals pure gold; 18 karats fine equals $\frac{18}{24}$ pure gold.

EXERCISE No. 263, MEASURES OF WEIGHT

The following problems provide oral practice in changing the expression of weight without changing the weight.

Express:

a. 6,000 pounds in tons
b. 3 pounds in ounces (troy)
c. 2 pennyweights in grains
d. 4 pounds in ounces (avoirdupois)
e. 4,480 pounds in tons
f. 40 pennyweights in ounces
g. 32 ounces in pounds
h. 40 hundredweight in tons
i. 48 grains in pennyweights
j. 60 ounces in pounds
k. 3 pounds in ounces (avoirdupois)
l. 2 carats in grains

EXERCISE No. 264, MEASURES OF WEIGHT

The following problems provide written practice in changing the expression of weight without changing the weight. Show all of your calculations on tablet paper.

1. At $16.00 per ounce, what is the value of a gold nugget which weighs 8 ounces 6 pennyweights 12 grains?
2. Express 2.48 pounds of gold (troy weight) in ounces.
3. Express 160 carats in grains.
4. Express 2 tons in ounces.
5. Express 3 tons 16 hundredweight 86 pounds in ounces.

6. Express 9 ounces in grains.
7. How many pounds are there in 92,160 grains?
8. Express 6 pounds in grains.
9. How many tons are there in 35,840 pounds?
10. Express 46 pounds in ounces (troy).
11. Express 26 long tons in pounds.
12. Express 368 ounces in pounds (avoirdupois).

MEASUREMENT OF TIME

Time measures are based on the movements of the earth and other bodies of the Solar system. The time required for the earth to make one revolution on its axis is designated as a day, and the time required to complete a revolution around the sun is one year. The month is derived from the revolution of the moon around the earth. The following units of measurement are used for measuring time.

60 seconds (sec.)	=1 minute	365 days	=1 common year (yr.)
60 minutes (min.)	=1 hour	12 months	=1 common year (yr.)
24 hours (hr.)	=1 day	366 days	=1 leap year (l. yr.)
7 days (d.)	=1 week	100 years	=1 century (C.)

The time required for the earth to make one revolution around the sun is 365 days, 5 hours, 48 minutes, and 49.7 seconds. This fraction of a day cannot be expressed very well in business, hence since it is almost one fourth of a day, one entire day is added every fourth year to make a leap year. This does not exactly take care of the fraction however, so every centennial year which is not divisible by four hundred is regarded as a common year. Below is given a list of the months with the number of days in each month.

Months in the Year

Months	Abbrev.	No.	Days	Months	Abbrev.	No.	Days
January	Jan.	1	31	July	July	7	31
February	Feb.	2	28	August	Aug.	8	31
March	Mar.	3	31	September	Sept.	9	30
April	Apr.	4	30	October	Oct.	10	31
May	May	5	31	November	Nov.	11	30
June	June	6	30	December	Dec.	12	31

As explained in the chapter on interest, it is customary in business to regard a year as twelve months of thirty days in each month or 360 days. This is only for convenience in making interest calculations.

EXERCISE No. 265, MEASUREMENT OF TIME

The following problems provide oral practice in measuring time.

Express:

a. 1 week in hours
b. 3 hours in minutes
c. 4 days in hours
d. 5 hours in minutes
e. 2 years in days
f. $2\frac{1}{2}$ minutes in seconds
g. 48 hours in days
h. 14 days in hours
i. 360 seconds in minutes
j. 96 hours in days
k. 720 seconds in minutes
l. 5,000 years in centuries

EXERCISE No. 266, MEASUREMENT OF TIME

The following problems provide written practice in measuring time. Show all of your calculations on tablet paper.

1. All years divisible by 4 are leap years, except centennial years, which must be divisible by 400. Since this is true, name all of the leap years between 1890 and 1930.

2. How many days are there in the first six months of a common year?

3. How many minutes are there in seven days?

4. How many days will the year 2,000 have?

5. Express 22 hours 49 minutes and 30 seconds in seconds.

6. Express 483,840 seconds in days.

7. Express 48 weeks in hours.

8. How many days are there in the last six months of a year?

9. Express 6 days 21 hours 50 minutes in seconds.

10. Express 3 centuries in days.

11. Express 2 weeks in hours.

12. How many hours are there in the month of June?

DENOMINATE NUMBERS

When it is desired to add, subtract, multiply, or divide denominate numbers, it is necessary to take into consideration the unit value of each article. These various processes are illustrated to make clear the proper position of the units before the process is begun.

The illustrations below show the application of the four fundamentals to denominate numbers. In the first illustration it is desired to add 4 bushels 3 pecks 2 quarts, 3 bushels 5 pecks 4 quarts, and 4 bushels 3 pecks 1 quart.

bu.	pk.	qt.
4	3	2
3	5	4
4	3	1
13	3	7

Since there are eight quarts in a peck, there is nothing to carry to the second column. The sum of the second column is 11, which is equal to 2 bu. and 3 pk.; 11 bu. plus 2 bu., equals 13 bu. The same plan is followed in the addition of all denominate numbers.

It is desired to ascertain the difference between 320 rods 4 yards 1 foot and 124 rods 1 yard 2 feet.

rd.	yd.	ft.
320	4	1
124	1	2
196	2	2

The process of subtraction is begun at the right as in abstract numbers. If the minuend is smaller than the subtrahend, it is necessary to borrow one. This unit must be expressed at its value given in the table. Thus, in order to subtract two feet from one foot it is necessary to borrow a yard of three feet. The same process is applied in the subtraction of all denominate numbers.

It is desired to find the weight of six packages of paper each weighing 7 lb. 5½ oz.

lb.	oz.
7	5½
	6
44	1

The process of multiplication is begun at the right as in abstract numbers. Six times 5½ oz. is 2 lb. 1 oz. Six times 7 is 42, plus 2 equals 44. The same process is applicable to the multiplication of all denominate numbers.

It is desired to divide 26 tons 5 hundredweight 98 pounds 2 ounces by five.

T.	cwt.	lb.	oz.
5)26	5	98	2
5	5	19	10

The number of tons is divided by five with a remainder of 1 T. or 20 cwt., which is added to the 5 cwt., and the sum divided by five. There is no remainder. Five is contained in 98 lb. 19 times with a remainder of 3. Three pounds is equal to 48 oz., 48 plus 2 divided by 5 equals 10. The same process is applicable to the division of all denominate numbers.

LEGAL WEIGHTS PER BUSHEL OF VARIOUS COMMODITIES

Jurisdiction concerned	Apples a	Apples, dried	Barley	Beans a	Beets	Blue-grass seed	Buckwheat	Carrots	Clover seed	Corn a	Indian or maize	Shelled	Corn meal a	Cotton seed a	Cranberries	Cucumbers	Flaxseed	Hemp seed	Hungarian grass seed
Federal Gov.	b 50	....	b 48	b 60	....	....	b 42	....	....	b 56	....	....	....	....	....	....	b 56	....	....
Alabama...	....	24	47	60	....	....	....	....	....	....	....	56	c 46	32	....	....	....	....	....
Arizona....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Arkansas...	d 50	24	48	e 60	....	14	52	....	60	....	....	56	48	33⅓	....	....	56	....	....
California...	....	....	50	....	....	....	40	....	....	....	52	....	....	....	....	....	....	....	....
Colorado...	....	....	48	60	....	14	52	....	60	....	56	....	50	....	....	....	....	44	....
Connecticut.	48	25	48	60	f 60	....	48	50	60	....	56	....	50	g 44	....	....	55	....	....
Delaware...	....	....	....	....	....	....	....	....	....	....	56	....	c 44	....	....	....	....	....	....
Dist. of Col..	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Florida.....	d 48	24	48	h 60	....	....	....	....	....	....	....	56	48	i 32	....	....	....	....	....
Georgia....	....	24	47	e 60	....	14	52	....	60	....	....	56	c 48	30	....	....	56	44	....
Hawaii.....	....	....	48	....	....	....	....	....	....	....	56	....	....	....	....	....	....	....	....
Idaho.....	d 48	24	48	60	56	j 14	50	50	60	....	k 70	56	48	....	....	....	56	44	50
Illinois.....	d 50	24	48	e 60	60	14	52	50	60	....	56	56	l 48	32	33	48	56	44	50
Indiana....	48	25	48	60	60	14	50	50	60	....	....	56	50	....	33	48	56	44	....
Iowa.....	48	24	48	m 60	56	14	48	50	60	n 50	....	56	48	....	....	48	56	44	50
Kansas.....	50	24	48	60	60	j 14	48	50	60	....	k 70	56	....	....	....	48	56	44	....
Kentucky...	....	24	47	e 60	....	14	56	....	60	....	....	56	50	....	....	....	56	44	50
Louisiana...	....	....	32	....	....	....	....	....	....	56	....	....	....	....	....	....	....	....	....
Maine.....	44	25	48	60	60	....	48	50	60	56	....	....	50	g 44	....	....	56	44	48
Maryland...	d 50	28	48	m 60	....	14	48	50	60	....	....	56	48	....	....	....	56	44	50
Mass.....	48	25	48	60	60	....	48	50	60	....	56	o 50	50	g 44	32	....	55	....	....
Michigan...	48	22	48	60	....	14	48	....	60	....	....	56	50	....	40	....	56	44	50
Minnesota..	d 50	28	48	60	50	14	50	45	60	n 48	....	56	....	....	36	48	56	50	48
Mississippi..	....	26	48	e 60	....	14	48	....	60	....	....	56	c 44	32	....	....	56	44	50
Missouri....	48	24	48	60	....	14	52	50	60	....	....	56	50	33	....	48	56	44	48
Montana...	45	....	48	60	50	14	52	50	60	....	....	56	50	....	....	....	56	44	50
Nebraska...	48	24	48	m 60	56	j 14	50	50	60	n 50	k 70	56	48	....	....	48	56	44	....
Nevada....	d 48	24	48	60	56	j 14	50	50	60	....	k 70	56	48	....	....	....	56	48	50
New Hamp..	48	25	48	p 60	60	....	48	50	60	o 50	56	....	50	....	32	....	56	....	....
New Jersey..	48	25	48	60	60	14	48	50	60	....	56	....	50	g 44	32	48	56	44	50
New Mexico	45	24	48	60	56	14	52	50	60	56	56	....	50	32	....	48	56	44	50
New York...	48	25	48	60	....	....	48	50	60	....	56	....	50	g 44	....	....	55	....	....
N. Carolina.	d 48	24	48	q 60	50	14	50	50	r 60	....	56	....	....	i 30	....	48	56	44	48
N. Dakota..	50	28	48	60	60	14	42	45	60	....	....	56	....	....	36	48	56	50	48
Ohio.....	48	24	48	60	56	....	50	50	60	....	k 68	56	48	....	....	....	56	44	50
Oklahoma..	48	24	48	60	60	14	52	50	60	....	....	56	50	32	....	48	56	44	48
Oregon.....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Penna.....	45	25	47	m 60	56	14	48	50	60	....	....	56	50	....	40	50	56	44	50
R. I.....	48	25	48	60	50	....	48	50	60	....	....	56	50	g 44	....	....	56	44	50
S. Carolina..	d 50	24	....	m 60	50	14	50	50	r 60	....	....	56	c 48	s 30	....	48	56	44	48
S. Dakota...	48	24	48	m 60	56	14	48	50	60	56	....	....	50	....	....	48	56	44	50
Tennessee..	d 50	24	48	m 60	50	14	50	50	r 60	....	....	56	c 50	28	....	48	56	44	48
Texas.....	d 50	28	48	e 60	60	14	52	50	60	....	....	56	c 50	32	32	48	56	44	48
Utah.....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Vermont...	48	....	48	60	60	....	48	50	60	....	56	56	50	....	32	48	55	....	50
Virginia....	....	28	48	q 60	....	14	48	50	60	....	....	56	48	30	....	....	56	44	48
Washington.	d 45	28	48	....	....	....	42	....	60	....	56	....	....	....	....	....	56	....	....
W. Virginia.	d 48	24	48	m 60	56	14	52	50	60	56	....	....	t 48	i 32	36	u 50	56	44	50
Wisconsin..	44	25	48	60	50	14	50	50	60	....	56	....	50	v 44	35	u 50	56	44	48
Wyoming...	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....

a Not defined.
b For customs purposes only.
c Bolted; unbolted, 48 pounds.
d Green apples.
e White beans.
f Sugar beets and mangel-wurzel.
g Sea-island cotton seed; upland cotton seed, 30 pounds.
h Shelled.
i Sea-island cotton seed, 44 pounds.
j Native blue-grass seed; English blue-grass seed, 22 pounds.
k Indian corn in ear.
l Unbolted, 48 pounds.
m Dried beans.
n Sweet corn.
o Cracked corn.
p Small white beans.
q Soy beans.
r Red and white.
s Seed of long staple cotton, 40 pounds.
t Bolted, 46 pounds.
u Green.
v Sea-island cotton seed.

LEGAL WEIGHTS PER BUSHEL OF VARIOUS COMMODITIES—Continued

Jurisdiction concerned	Millet	Oats	Onions a	Onion sets	Orchard grass seed	Parsnips	Peaches a	Peanuts (or ground peas)	Pears a	Green peas, unshelled	Peas a	Potatoes	Sweet Potatoes	Red top	Rye	Timothy seed	Tomatoes	Turnips a	Wheat
Federal Gov.	....	b 32	b 57	....	....	....	b 50	....	b 50	....	b 60	....	....	....	b 56	....	....	....	b 60
Alabama	....	32	....	....	....	....	....	....	....	....	60	60	55	....	56	....	....	55	60
Arizona	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Arkansas	50	32	57	....	14	....	....	....	....	....	60	60	50	14	56	60	....	57	60
California	....	32	....	....	....	....	....	....	....	....	....	....	....	....	54	....	....	....	60
Colorado	....	32	57	....	....	....	....	....	....	....	....	60	....	....	56	45	....	....	60
Connecticut	....	32	52	....	....	45	....	....	....	....	60	60	54	....	56	45	....	c 50	60
Delaware	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	60
Dist. of Col.	....	....	....	....	....	....	....	....	....	....	....	60	....	....	....	....	....	....	....
Florida	50	32	56	....	....	....	d 54	22	55	....	....	60	56	....	56	....	....	54	60
Georgia	....	32	57	....	....	....	....	25	....	....	60	60	55	....	56	45	....	55	60
Hawaii	....	32	....	....	....	....	....	....	....	....	....	....	....	....	56	....	....	....	60
Idaho	50	32	57	....	....	....	48	....	....	....	e 60	60	50	....	56	45	56	55	60
Illinois	50	32	57	f 30	14	50	48	g 20	58	32	h 60	60	50	14	56	45	56	55	60
Indiana	50	32	57	....	14	55	48	....	50	....	....	60	55	14	56	45	60	55	60
Iowa	50	32	52	f 28	14	45	48	22	45	50	h 60	60	50	14	56	45	50	55	60
Kansas	i 50	32	57	....	....	....	48	....	45	....	e 60	60	50	....	56	45	56	55	60
Kentucky	50	32	57	j 36	14	....	....	24	....	....	60	60	55	....	56	45	....	60	60
Louisiana	....	32	....	....	....	....	....	....	....	....	....	....	....	....	32	....	....	....	60
Maine	50	32	52	....	14	45	48	g 20	58	....	60	60	54	14	56	45	56	c 50	60
Maryland	k 50	32	54	....	14	40	l 40	22	....	....	m 60	60	60	14	56	45	60	60	60
Mass.	....	32	52	....	....	45	48	g 20	58	28	n 60	60	54	....	56	45	56	55	60
Michigan	50	32	54	....	14	....	....	....	....	....	60	60	56	14	56	45	....	58	60
Minnesota	48	32	52	f 28	14	42	48	22	45	....	n 60	60	55	14	56	45	50	55	60
Mississippi	50	32	57	....	....	....	....	24	....	....	60	60	54	....	56	45	....	55	60
Missouri	50	32	57	o 28	14	44	48	....	48	56	p 60	60	56	14	56	45	45	q 42	60
Montana	....	32	57	....	....	50	....	....	45	....	60	60	....	....	56	45	....	50	60
Nebraska	50	32	57	f 28	41	50	48	22	45	....	h 60	60	50	14	56	45	56	55	60
Nevada	50	32	57	....	....	50	48	....	....	....	e 60	60	50	....	56	45	56	56	60
New Hamp.	....	32	52	....	....	45	48	g 20	58	....	60	60	54	....	56	45	56	55	60
New Jersey	50	32	57	o 28	14	50	48	g 20	58	....	h 60	60	54	14	56	45	56	55	60
New Mexico	50	32	57	f 30	14	42	48	22	48	....	60	60	50	....	56	45	50	56	60
New York	....	32	57	....	....	....	....	....	....	....	60	60	54	....	56	45	....	....	60
N. Carolina	50	32	r 57	f 28	14	50	r 50	22	r 56	....	h 60	56	56	14	56	45	56	50	60
N. Dakota	50	32	52	f 28	14	42	....	22	45	....	60	60	46	....	56	45	50	60	60
Ohio	50	32	56	s 28	....	50	48	....	....	....	60	60	50	....	56	45	56	60	60
Oklahoma	50	32	57	o 28	14	44	48	22	48	56	60	60	55	14	56	45	45	q 42	60
Oregon	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Penna.	50	32	50	s 28	14	50	48	22	50	56	h 60	60	54	14	56	45	60	60	60
R.I.	50	32	50	....	....	50	48	....	....	....	60	60	54	....	56	45	56	50	60
S. Carolina	t 50	32	r 56	f 28	14	50	r 50	23	36	....	h 60	60	50	14	56	....	56	50	60
S. Dakota	t 50	32	52	f 30	14	48	48	20	45	50	h 60	60	54	14	56	45	50	55	60
Tennessee	t 50	32	r 56	u 28	14	50	r 50	23	r 56	30	h 60	60	50	14	56	45	56	50	60
Texas	50	32	57	f 30	14	50	50	g 20	58	....	60	60	55	14	56	45	55	55	60
Utah	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Vermont	50	32	52	....	....	45	48	g 20	58	48	60	60	54	14	56	45	56	60	60
Virginia	50	32	57	....	14	50	....	22	....	....	v 60	56	56	40	56	45	60	55	60
Washington	....	32	....	....	....	....	....	....	w 45	....	....	60	....	....	56	....	....	....	60
W. Virginia	50	32	55	f 28	14	42	48	23	50	....	h 60	60	50	14	56	45	56	55	60
Wisconsin	50	32	50	s 32	....	44	48	....	48	....	60	60	54	14	56	45	56	42	60
Wyoming	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....

a Not defined.
b For customs purposes only.
c Common English turnips.
d Green peaches.
e Shelled, dry.
f Top sets; bottom sets, 32 pounds.
g Roasted; green, 22 pounds
h Dried.
i Hungarian.
j Bottom onion sets.
k German and American.
l Peaches (peeled); unpeeled, 32 pounds.
m Cowpeas; dried peas, 60 pounds.
n Smooth; wrinkled, 56 pounds.
o Top onion sets.
p Including split peas.
q Common turnips.
r Matured.
s Not stated whether top or bottom sets.
t German, Missouri, and Tennessee millet seed.
u Bottom onion sets, 32 pounds.
v Black-eyed and other cowpeas.
w Green.

EXERCISE NO. 267, APPLYING THE FUNDAMENTAL PROCESSES

The following problems provide written practice in applying the four fundamental processes to denominate numbers. Arrange your work on tablet paper in the same order as in the illustrations.

1. One side of a square field is 140 rods 3 yards 2 feet 4 inches. What is the distance around the field?

2. Which is the heaviest 20 bushels of wheat, 30 bushels of barley, 45 bushels of oats, or 35 bushels of rye? See the table on pages 444 and 445 for the weights of these grains.

NOTE: Use the weights in your state.

3. Divide 26 years 15 days 20 hours 15 minutes by 24.

4. Find the weight of 8 bars of gold each weighing 9 ounces 18 pennyweights 6 grains.

5. At the mint price of $15.25 per ounce, what is the value of a sack of gold weighing 7 pounds 8 ounces 13 pennyweights 18 grains?

6. From 26 bushels of potatoes two lots were taken as follows: 7 bushels 3 pecks and 11 bushels 3 pecks. How many bushels were left?

7. Divide 14 acres 122 square rods into 5 equal parts.

8. From a piece of beef weighing 38 pounds a butcher sold the following cuts weighing: 3 pounds 12 ounces; $7\frac{1}{2}$ pounds; 6 pounds 8 ounces; and 5 pounds 7 ounces. How much was left?

9. Find the cost of 2,600 pounds of oats at 40c per bushel.

10. Divide 42 tons 600 pounds by 6.

11. Subtract 168 rods $4\frac{1}{2}$ yards $2\frac{1}{2}$ feet from 186 rods $4\frac{1}{2}$ yards 3 feet.

12. Multiply 6 gallons 3 quarts $1\frac{1}{2}$ pints by 8.

EXERCISE NO. 268, REVIEW PROBLEMS IN DENOMINATE NUMBERS

1. What will it cost to build a three-wire fence around a section of land, if posts, set 2 rods apart, cost 45 cents each, and a single wire costs $\frac{3}{4}$ of a cent a foot?

2. The distance around a square field is 146 rods. How many acres does it contain?

3. The circumference of a bicycle wheel is 7 ft. 8 in. If the rider's right foot makes 20 strokes a minute and the wheel makes $2\frac{1}{2}$ turns to each stroke of his foot, how long will it take him to travel a mile?

4. There are 276 rows of corn in a field. If the outside rows are four feet from the edge of the field, and the rows are $3\frac{3}{4}$ feet apart, how many rods wide is the field?

5. A building is 50 feet long. If 5 windows each 3 ft. 6 in. wide, are to be set into the side wall, an equal distance apart with no window closer to the end of the building than 8 ft., how far apart should the windows be placed?

6. A boat making $9\frac{1}{2}$ miles an hour, is forced to stop, retrace its course $2\frac{1}{2}$ miles and then resume its journey. If $1\frac{1}{2}$ minutes loss of time is allowed for each turn and the distance between the ports was $15\frac{3}{4}$ miles, how long did it take for the trip?

7. A field 40 rods square is to be fenced off into stock yards each 4 rods square. What will it cost to build the outside and cross-section fences at $5 a rod?

8. What will it cost, at $17.50 per cubic yard, to construct the foundation of a building 46 ft. long, $32\frac{1}{2}$ ft. wide, the wall to be $7\frac{1}{2}$ ft. high and 12 in. thick; deductions are to be made for one door 6 ft. by 3 ft. 8 in., and six windows $2\frac{1}{4}$ ft. by $1\frac{1}{2}$ ft.?

9. A field $40\frac{1}{4}$ rods by $78\frac{1}{2}$ rods is planted to corn. If a bushel plants $7\frac{1}{2}$ acres, what will the seed cost at $2.50 a bushel?

10. What will it cost for blocks to pave a street 1,520 feet long and $45\frac{3}{4}$ feet wide if each block covers a space $4\frac{1}{2}''$ x $8''$ and they cost $37.50 per M?

11. A rug 12 feet square is placed in the center of a room $16\frac{1}{2}$ feet wide and 18 feet long. What will it cost to polish the remainder of the floor at 30c a square yard if the polish extends six inches under the edges of the rug?

12. A boy plowed a strip 2 rods wide around a field 48 rods x 72 rods. What did he earn at $4.50 an acre?

13. All of a twenty-two story building, 204 ft. long and 78 ft. wide inside measurements, is occupied by the Marx Mfg. Co. How many acres of floor space are occupied?

14. The area of South Dakota is 77,615 square miles. Sections 16 and 36 of each township are set aside for school purposes. What is the value of the South Dakota school lands at an average price of $35.00 an acre?

15. How many square yards are in the walls and ceiling of a room $16\frac{1}{2}$ feet by 14 feet, and $8\frac{1}{3}$ feet high, deducting for 1 door $4\frac{1}{2}'$ x $6\frac{1}{2}'$ and 4 windows $2\frac{1}{2}'$ x 6'?

16. A tract of land in the form of a right-angled triangle is 310 rods long and 45 rods wide at the base. How many acres does it contain?

17. How many cubic yards of dirt must be removed for a basement $20\frac{1}{2}'$ x $36\frac{2}{3}'$ and $7\frac{1}{2}'$ deep?

18. A can 8 inches square is 18 inches high. How many gallons will it contain? (231 cu. in. = 1 gal.)

19. A swimming pool 28 feet wide and 60 feet long is $4\frac{1}{2}$ feet deep at one end and $8\frac{1}{2}$ feet at the other. How many gallons does it contain?

20. How many bushels of wheat will a box car 48′ 6″ x 7′ 8″ inside measurements hold, if filled to a depth of $4\frac{1}{2}$ feet?

21. A circular grain elevator is 20 feet in diameter (inside) and 42 feet high. Find the value of its contents when filled with wheat worth $1.80 a bushel.

22. An oil tank is $38\frac{1}{2}$ feet in diameter and 20 feet deep. Find the value of the contents at 22 cents a gallon.

23. A vat $2\frac{1}{2}'$ x $3\frac{1}{2}'$ x $1\frac{1}{2}'$ will hold how many quarts (a) (dry measure)? (b) Liquid measure?

24. A pump chain carries 24 cups, each 8″ x $4\frac{1}{2}$″ x 5″ and makes 54 revolutions per hour. How many barrels ($31\frac{1}{2}$ gallons) of water will it lift in 24 hours, if the cups carry only $\frac{7}{8}$ of their capacity.

25. Find the cost of a ton of mill feed made of equal parts (by weight) of oats and corn, if a bushel of oats weighs 32 lbs. and costs 75c, and a bushel of corn weighs 56 lbs. and costs $1.20.

26. If an empty 30-gallon bbl. weighs 26 lbs., what will be the freight at 52c a cwt., on 48 bbls., filled with molasses that weighs 12 lbs. per gallon?

27. A cu. in. of wrought iron weighs .281 lbs. What would be the weight in tons of 4,000 straps of iron $2\frac{1}{4}''$ x $\frac{1}{4}''$ x 20 ft.?

28. A cu. in. of platinum weighs .819 lbs., and a cu. in. of aluminum weighs .096 lbs. How many cubic feet of aluminum is equal in weight to a cu. ft. of platinum?

29. A silver dollar weighs 412.5 grains troy. What would be the weight avoirdupois of 5,000 silver dollars? Give answer in pounds.

30. The gross weight of a carload of coal was 152,425 lbs. The car weighed 24,000 lbs. Find the value of the coal at $4.20 per long ton.

31. A shipment of sugar weighed 7,126 lbs., gross. Find the value at $8\frac{1}{3}$c a lb., if the tare was 198 lbs.

32. By using pasteboard cartons instead of wooden boxes a firm reduced the weight of its shipments one fifth. If all shipments were made in units containing 1 dozen articles, and each unit weighed 76 lbs., when packed in wood, what was the saving per article to its customers, if freight rates were $1.10 a cwt.?

33. Find the cost per ream of 720 reams of 32-lb. paper, at $16\frac{3}{4}$c a lb., if freight on the shipment is 74 cents a cwt.

34. A beef was sold at $7\frac{1}{2}$c a pound live weight and brought $93. If $\frac{2}{5}$ of the weight is lost in killing and dressing, at what price per lb. must the meat be sold to bring $120?

35. A carload of 3,170 melons weighed 35,426 lbs. If they sold at $95 a C. and the freight charge was 80 cents a cwt., what were the net sales?

36. Bought 7,250 cabbages at $4.20 a dozen and sold them at $42 a C. Find the profit.

37. C. T. Gray bought 217 lbs. of lime at $37\frac{1}{2}$c a hundred pounds and 1,165 ft. of flooring at $56.40 a thousand feet in exchange for which he gave 642 eggs at 47c a dozen. What was the balance owed?

38. If typewriting paper is bought at 75c a ream, how many sheets can be sold for 5c and a profit of $\frac{1}{5}$ on cost realized?

39. Kees Bros. Grocery Company bought oranges at $2.75 per C. They wished to make a profit of $\frac{1}{5}$ of cost. What will be

the selling price (a) per orange? (b) per dozen? How many will they sell (c) for a dime? (d) for a quarter? (e) for a half dollar?

40. Woolworth & Company bought candles at $14.50 a M. They put them in boxes holding one dozen each, which cost $6.25 a gross. At what price should they sell them to gain $\frac{1}{4}$ on cost?

41. Twenty shoe buttons costing $1.75 a M. are required for each shoe. What will the buttons cost for an order of 960 pairs of these shoes?

42. 50,000 sheets of paper were bought at a cost of $12\frac{1}{2}$c per pound. If the weight was $30\frac{1}{2}$ lbs. to the ream what was the cost? (Count 500 sheets to a ream.)

43. How many sheets of paper $8\frac{1}{2}''$ x 11″ can be cut from 10 reams, the sheets being 22″ x 34″?

44. What will it cost to rule 91,000 sheets of paper, at a ruling cost of $2\frac{1}{2}$c per pound, the weight being $29\frac{1}{2}$ lbs., to the ream?

45. If 18 horses in 60 days eat 624 bushel 1 peck 4 quarts of oats, how much does each horse eat each day?

MEASURES OF VALUE

Money is the medium of exchange in measuring values. The tables of United States, English and French money are given below.

United States Money

10 mills = 1 cent (c)	10 dimes = 1 dollar ($)
10 cents = 1 dime (d.)	10 dollars = 1 eagle (E.)

NOTE: The coins in general circulation are pennies, nickels, dimes, quarters, half dollars and dollars. Gold coins are not in general circulation, but coins in value of five, ten and twenty dollars may be secured if desired. Paper money is used in denominations of one, two, five, ten, twenty, fifty and one hundred dollars.

English Money	French Money
4 farthings = 1 penny (*d.*)	10 millimes = 1 centime (ct.)
12 pence = 1 shilling (*s.*)	10 centimes = 1 decime (dc.)
20 shillings = 1 pound (£)	10 decimes = 1 franc (fr.)

The table on pages 451 and 452 shows the values in United States money of the coins of foreign countries.

VALUE OF FOREIGN COINS IN UNITED STATES MONEY

Country	Legal Standard	Unit Used	Value in U. S. Money
Argentine Republic	Gold	Peso	$0.9648
Austria	Gold	Schilling	.1407
Belgium	Gold	Belga	.1390
Bolivia	Gold	Boliviano	.3893
Brazil	Gold	Milreis	.5462
British Colonies in Australasia and Africa	Gold	Pound Sterling	4.8665
British Honduras	Gold	Dollar	1.0000
Bulgaria	Gold	Lev	.1930
Canada	Gold	Dollar	1.0000
Chili	Gold	Peso	.0217
*China	Silver	Tael, Haikwan	.6769
Colombia	Gold	Peso	.9733
Costa Rica	Gold	Colon	.4653
Cuba	Gold	Peso	1.0000
Czecho-Slovakia	Gold	Krone	.2026
Denmark	Gold	Krone	.2680
Dominican Republic	Gold	Dollar	1.0000
Ecuador	Gold	Sucre	.2000
†Egypt	Gold	Lb. (100 Piasters)	4.9431
Esthonia	Gold	Kroon	.2680
Finland	Gold	Markka	.0252
France	Gold, Silver	Franc	.1930
Germany	Gold	Reichsmark	.2382
Great Britain	Gold	Pound Sterling	4.8665
Greece	Gold, Silver	Drachma	.1930
Guatemala	Gold	Quetzal	1.0000
Haiti	Gold	Gourde	.2000
Honduras	Gold	Lempira	.5000
Hungary	Gold	Pengo	.1749
India (British)	Gold	Rupee	.3650
Indo-China	Silver	Piaster	.4382
Italy	Gold	Lira	.1930
Japan	Gold	Yen	.4985

*China: Customs' unit is Haikwan Tael. The values of other taels are based on their relation to the value of the Haikwan Tael. The Yuan silver dollar of one hundred cents is the monetary unit of the Chinese Republic. It is equivalent to .637— of the Haikwan tael. Dollar, Yuan, equals $0.4311.

†Egypt: The actual standard is the British pound sterling which is legal tender for 97½ piasters.

VALUE OF FOREIGN COINS IN UNITED STATES MONEY—*Continued*

COUNTRY	LEGAL STANDARD	UNIT USED	VALUE IN U. S. MONEY
Jugo-Slavia	Gold	Dinar	.1930
Latvia	Gold	Lat.	.1930
Liberia	Gold	Dollar	1.0000
Lithuania	Gold	Litas	.1000
Mexico	Gold	Peso	.4985
Netherlands	Gold	Guilder (Florin)	.4020
Newfoundland	Gold	Dollar	1.0000
Nicaragua	Gold	Cordoba	1.0000
Norway	Gold	Krone	.2680
Panama	Gold	Balboa	1.0000
Paraguay	Gold	Peso	.9648
Persia	Silver	Kran	.0747
Peru	Gold	Libra	4.8665
Philippines	Gold	Peso	.5000
Poland	Gold	Zloty	.1930
Portugal	Gold	Escudo	1.0805
Roumania	Gold	Leu	.1930
*Russia	Gold	Ruble	.5146
Salvador	Gold	Colon	.5000
Siam	Gold	Tical	.3709
Spain	Gold, Silver	Peseta	.1930
Straits Settlements	Gold	Dollar	.5678
Sweden	Gold	Krona	.2680
Switzerland	Gold	Franc	.1930
Turkey	Gold	Piaster	.0440
Uruguay	Gold	Peso	1.0342
Venezuela	Gold	Bolivar	.1930

*Russia: Russia has stabilized its currency by use of a new standard, the chervonets; equivalent to 10 gold rubles (gold par of exchange, $5.146) and is issuing bank notes on that standard based on a gold reserve.

CHAPTER XXXIII

PRACTICAL MEASUREMENTS

MEASUREMENT OF CIRCLES

A plane figure, bounded by a curved line which is at all points equally distant from a point within, called the center, is a *circle.*

The *circumference* is the distance around this plane figure.

A straight line passing through the center of a circle and connecting two points on the circle is called the *diameter.*

A line drawn from the center of the circle to a point on the circle is called the *radius.*

The circumference of a circle is 3.1416 (practically $3\frac{1}{7}$) times the diameter.

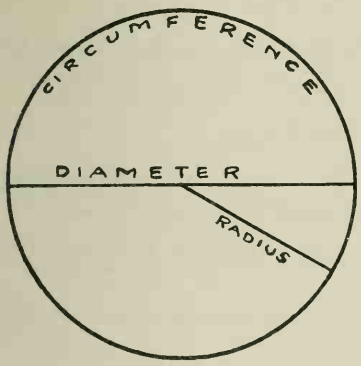


ILLUSTRATION:

Find the circumference of a circle whose diameter is 8 inches.

3.1416×8 equals 25.13 or 25.13 inches the circumference of the circle.

EXERCISE No. 1, MEASUREMENT OF CIRCLES

1. Find the circumference of a circle whose diameter is (a) 6 inches; (b) 10 inches; (c) 18 inches.

2. Find the circumference of a circle whose radius is (a) 1 ft. 6 in.; (b) 2 ft., 9 in.; (c) 27 in.

3. Find the diameter of a circle whose circumference is (a) 30 in.; (b) 6 ft.

4. Find the radius of a circle whose circumference is 32 ft., 8 in.

The *area* of a circle equals the circumference times $\frac{1}{4}$ the *diameter*.

ILLUSTRATION:

Find the area of a circle whose radius is 8 inches.

SOLUTION

A equals C$\times\frac{1}{4}$ of 16

C equals 3.1416$\times$16 or 50.27 inches

Then A equals 50.27$\times$4

Area equals 201.08 sq. in.

EXERCISE No. 2, MEASUREMENT OF CIRCLES

1. A cistern is 12 ft. in diameter. What is the area of the bottom in sq. ft.? Show drawing of cistern.

2. How many acres inside a circular field 70 rds. in diameter?

3. What is the diameter in yds. of a circular park 2 mi. in circumference?

4. How many times will a wheel 3 ft. in diameter revolve in running 8 mi.?

5. How many square feet of iron will be required to make a stack 60 ft. high and 6 ft. in diameter, allowing 2 in. for joining?

MEASUREMENT OF CYLINDERS

A solid having a uniformly curved surface, and whose ends or bases are equal parallel circles is called a *cylinder*.

The perpendicular distance between the bases is called the *altitude*.

The volume of a cylinder equals area of base times the altitude.

EXERCISE No. 3, MEASUREMENT OF CYLINDERS

1. Find the volume of a cylinder 3 ft. in diameter having an altitude of 10 ft.

2. Find the volume of a cylinder 6 ft. in diameter having an altitude of 12 ft.

3. Find the volume of a cylinder 12 ft. in diameter having an altitude of 20 ft.

4. A cylinder has a volume of 201.0624 cu. ft.; if the altitude is 16 ft., what is the diameter?

5. The diameter of a cylinder is 10 in. and its volume is 785.4 cu. in. What is the altitude?

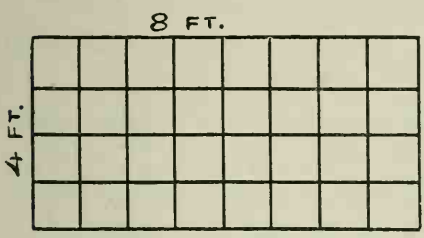
MEASUREMENT OF RECTANGLES

A *rectangle* is a plane figure bounded by four straight lines and whose angles are right angles.

The *area* of a rectangular figure is the product of the length and width expressed in units of the same denomination.

EXAMPLE:

Find the area of a rectangular walk 8 ft. long and 4 ft. wide.



EXPLANATION:

Let the figure represent the walk. Let us consider the walk as being made up of 8 rows of squares each containing 4 sq. ft. Therefore $8 \times 4 = 32$ or 32 sq. ft. is the area.

EXERCISE No. 4, MEASUREMENT OF RECTANGLES

1. Find the area of a room 12 ft. by 16 ft.

2. Find the number of square yards in a rug 13 ft. 6 in. by 10 ft. 8 in.

SOLUTION

$$13\tfrac{1}{2} \text{ ft.} \times (10\tfrac{2}{3}) \text{ ft.} \div 9 = \frac{27 \times 32}{2 \times 3 \times 9} = 16 \text{ sq. yds.}$$

We divide by nine because there are 9 sq. ft. in one sq. yd.

3. How many square feet in a floor 21 ft. 4 in. by 22 ft. 6 in.?

4. How many acres in a rectangular field $\frac{3}{4}$ mile long and $\frac{1}{2}$ mile wide?

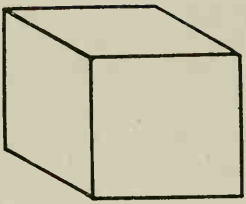
5. How many posts will be required to fence a field 160 rds. long and 80 rds. wide; posts to be set 12 ft. apart?

MEASUREMENT OF RECTANGULAR SOLIDS

Any figure having length, breadth and thickness is a *solid.*

The amount of space a solid occupies is said to be its *volume.*

A solid figure bounded by six rectangles is a *rectangular solid.*



RECTANGULAR SOLID

The *volume* of a rectangular solid equals the length times the breadth times the height expressed in units of the same denomination.

EXAMPLE:

What is the volume of a rectangular solid 8 ft long, 6 ft. thick, and 2 ft. high?

$8 \times 6 \times 2 = 96$ cu. ft.

EXERCISE No. 5, MEASUREMENT OF RECTANGULAR SOLIDS

1. Find the volume in cu. yds. of the dirt removed in excavating a cellar 12 ft. long, 8 ft. wide and 7 ft. deep.

2. How many yds. of dirt are removed in digging a ditch $\frac{1}{2}$ mile long, 6 ft. deep, and 2 ft. wide?

3. In measuring grain, the stricken bushel contains 2150.42 cu. in. How many bushels of wheat in a bin 12 ft. x 8 ft. x 4 ft.?

SUGGESTION:

There are 1728 cu. in. in a cubic foot. Each cubic foot in the bin would, therefore, contain $\frac{1728}{2150.42}$, or .8+bu.

4. A book concern received from the publishers a car load of books, packed in cases 4 ft. long, 3 ft. wide and 3 ft. high. If the car was 40 ft. long, 8 ft. wide and 8 ft. high, how many cases were packed in the car?

5. If a wall 100 ft. long, 8 ft. high and 2 ft. thick is built of bricks 8″ x 4″ x 2″, (a) how many bricks will be required, assuming that 22 bricks laid in mortar are required for each cu. ft.? (b) Find the cost of the brick at $30 per M.

MEASUREMENT OF WOOD

A *cord* of wood is 8 ft. long, 4 ft. wide and 4 ft. high; it contains 128 cu. ft.

EXERCISE No. 6, MEASUREMENT OF WOOD

1. Find the number of cords in a pile of wood, 96 ft. long, 48 ft. wide, and 4 ft. high?

2. At $20 per cord, what is the value of a pile of wood, 8 rds. long, 16 ft. deep, and 8 ft. high?

SQUARE ROOT

The *square root* of a number is one of the two equal factors which produce that number; as 4×4 equals 16, and $\sqrt{16}$ equals 4.

A number may not be an exact square. In this case carry to three places beyond the decimal in extracting the square root.

To find the square root ($\sqrt{\ }$) of a number:

$\sqrt{6'25} = 25$

5 4

4ø 225

225

EXPLANATION:

Beginning at units separate the number into periods of two figures each. 4 is the largest perfect square in 6, the lefthand period. The square root of 4 is 2. 4 is written under 6 and subtracted from it giving a remainder of 2. We bring down the next group, 25. The 2, or first number in the root, is doubled. We add an 0 making 40 for a trial divisor. We find that 40 is contained in 225, 5 times. Adding 5 to the trial divisor makes 45, the complete divisor. Multiplying 45 by 5 equals 225 which we write under 225. When this is subtracted there is no remainder, therefore 25 is the square root of 625.

In larger numbers the same form is followed.

$\sqrt{3'06'25} = 175$

7 1

2ø 206

189

5 1725

34ø 1725

EXERCISE No. 7, SQUARE ROOT

1. $\sqrt{256}$
2. $\sqrt{7921}$
3. $\sqrt{126736}$
4. $\sqrt{\ 3\ }$ to 4th decimal
5. $\sqrt{25 \times 81}$
6. $\sqrt{57'48'67'24}$
7. $\sqrt{\frac{2}{6}\frac{2}{2}\frac{5}{5}}$
8. $\sqrt{\frac{1}{4}}$

MEASUREMENT OF TRIANGLES

A *triangle* is a plane figure having three straight sides.

The distance around a plane figure is called the *perimeter*.

Either side may be assumed as the *base*, but the side on which the triangle is supposed to rest is called the *base*.

The point opposite the base is called the *apex* of the triangle.

The perpendicular distance from the apex to the base, is called the *altitude.*

The square on the hypotenuse of a right-angled triangle equals the sum of the squares on the other two sides.

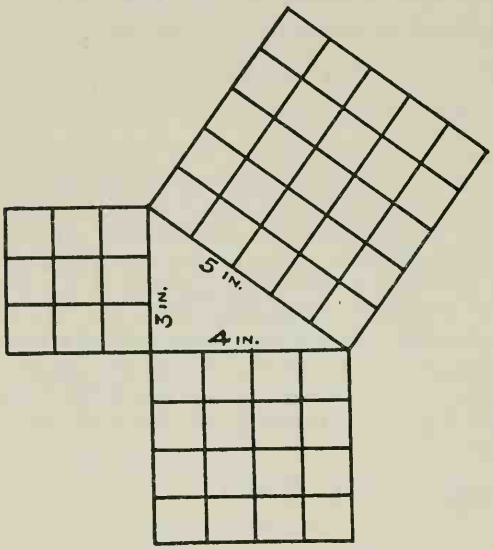


ILLUSTRATION:

Find the hypotenuse of a right-angled triangle whose base is 4 in. and altitude 3 in.

$4^2 = 16$

$3^2 = 9$

$4^2 + 3^2 = 16 + 9 = 25$

$\sqrt{25} = 5$, number in. in hypotenuse.

Count the squares in the illustration.

To find the hypotenuse of a right-angled triangle, extract the square root of the sum of the squares of the base and perpendicular.

To find either side of a right-angled triangle, having the hypotenuse and one side given, extract the square root of the difference of the squares of the hypotenuse and the given side.

EXERCISE No. 8, MEASUREMENT OF RIGHT-ANGLED TRIANGLES

1. Find the hypotenuse of a right-angled triangle having a base of 12 ft. and a perpendicular of 9 ft.

2. Find the hypotenuse of a right-angled triangle having a base of 8 ft. and a perpendicular of 6 ft.

3. Find the base of a right-angled triangle having a hypotenuse of 45 ft. and a perpendicular of 27 ft.

4. Find the perpendicular of a right-angled triangle having a hypotenuse of 15 ft. and a base of 10 ft.

5. The ridge of the roof of a barn is 16 ft. above the rafters. The roof is 25 ft. wide. How wide is the barn? Show drawing.

6. A room is 18 ft. long, 12 ft. wide, and 8 ft. high. Find the longest distance between a lower and an upper corner. Draw diagram.

EXERCISE No. 9, MEASUREMENT OF TRIANGLES

1. It is 60 rds. in a direct line from one corner of a triangular field to the opposite side, and the length of the latter is 75 rds. How many acres in the field?

The *area* of a triangle is equal to one half the product of its base and altitude.

ILLUSTRATION:

The base of a triangle is 6 ft. and the altitude 8 ft. *Find the area.*

$$\frac{6\times 8}{2}=24 \text{ sq. ft.}$$

2. A catcher standing 10 feet back of home plate throws a ball to second base. Assuming the ball travels in a straight line, how far does the ball travel if the distance between the bases is 90 ft.?

3. A football player received the kickoff on the 0 yd. line, right-hand corner of the field. He ran through a broken field to the 50 yd. line on the opposite side of the field where he was

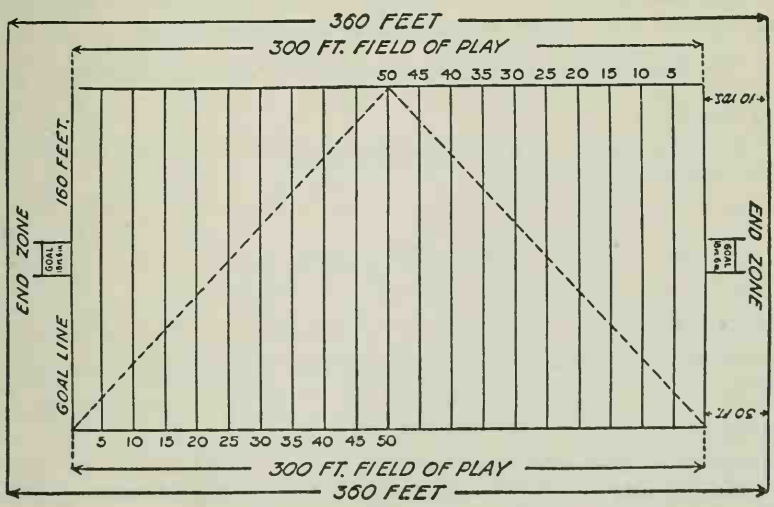
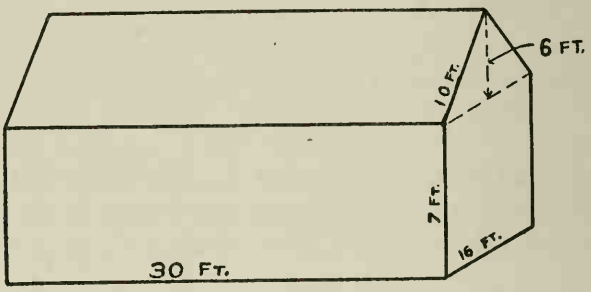


DIAGRAM OF FOOTBALL FIELD

tackled, but not downed; he again started for a touchdown and made it after a diagonal run to the opposite side of the field. Assuming that he ran in a straight line from the 0 yd. line to the 50 yd. line and then to the goal line opposite, how far did he run?

4. What will be the cost of the canvas required in building a summer cottage according to the dimensions given in the following illustration; the canvas is to be 36 inches wide and costs 75c per linear yard. No allowance is made for windows or doors.



MEASUREMENT OF LUMBER

Lumber is sold by the *board foot*, which is a board 12 in. by 12 in. and 1 in. thick, and contains 144 cubic inches.

To find the board feet in a piece of lumber or timber:

ILLUSTRATION:

Find the number of board feet (bd. ft.) in 24 pieces each 18 ft. long, 6 in. wide and 1 in. thick.

$$\frac{\cancel{24}^{2} \times 18 \times 6 \times 1}{\cancel{12}} = 216 \text{ bd. ft.}$$

EXPLANATION:

Dividing by 12 changes the inches to feet. When lumber is 1 in. thick the sq. ft. = the bd. ft. as $18 \times 6 \div 12 = 9$ bd. ft. in each bd.

$$9 \times 24 = 216 \text{ or } 216 \text{ bd. ft.}$$

Therefore it follows: To find the bd. ft.—

Multiply the number of cubic feet in the timber by 12 or multiply the area of one side in sq. ft. by the thickness in inches.

EXERCISE No. 10, MEASUREMENT OF LUMBER

1. How many bd. ft. in 12 pieces of lumber, 12 ft. long, 8 in. wide and 1 in. thick?

2. How many bd. ft. in 18 pieces of lumber 24 ft. long, 4 in. wide and 2 in. thick?

3. How many bd. ft. in 30 pieces of timber 18 ft. long, 6 in. square?

4. At $60.00 per M., what will be the cost of the lumber to build a silo, 60 ft. high and 12 ft. in diameter, the lumber to be 4 in. wide and 1 in. thick. $\frac{1}{4}$ allowance for waste. The bottom to be concrete and top of galvanized iron?

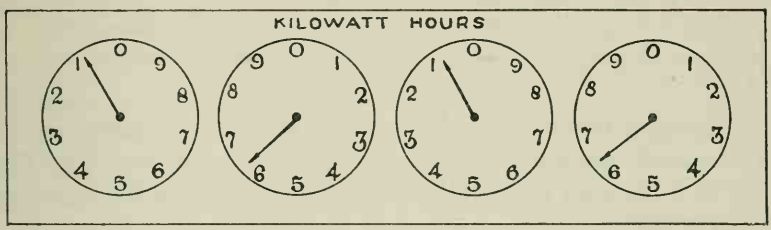
5. What will it cost to lay a floor in a room 18 ft. by 26 ft. of 4 in. lumber at $80 per thousand? $\frac{1}{4}$ allowance for waste.

METERS

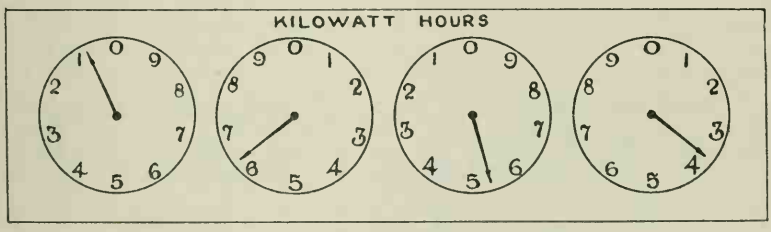
The three meters in common use are Electric, Gas and Water.

Electric Meter

METER 1.



METER 2.

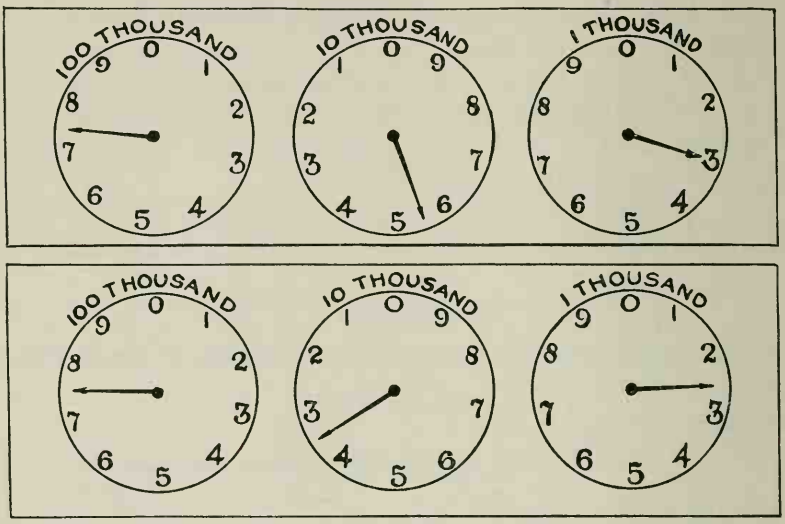


EXPLANATION:

Beginning at the left dial read the number the hand has just gone by. The first reading is 0607. The second reading is 0654. The difference is 47 or the number of kilowatt hours consumed between the first and second readings.

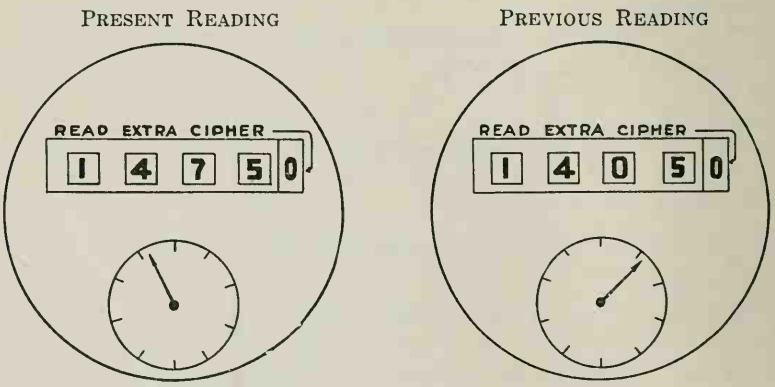
Gas Meter

The first group represents the meter on October 31. Reading 75,300. The second group represents the same meter as of October 1. Reading 73,300. The difference between the two is 2,000 or 2,000 cu. ft. gas consumed. Gas is usually sold by the 1,000 cu. ft.



Water Meter

The water meter is simple to read. A reading is taken of the meter when installed and then usually once a month. The difference between old reading and new is the number of cubic feet of water consumed. Water is sold by the cubic foot.



1475.0 − 1405.0 = 70 or 70 cu. ft. of water used.

CHAPTER XXXIV

METRIC SYSTEM

The metric system of weights and measures is a decimal system. It is built on a scale of ten, which means that ten of one denomination is equal to one of the next higher denomination. This is a more convenient system than the unrelated method given in the tables discussed in the preceding chapter. The metric system is used by practically all foreign countries except England, and in scientific research in the United States. The tendency is to use it more extensively, and it is hoped that it will soon be the standard measurement throughout the world. The metric system originated in France early in the nineteenth century. It is based on the meter, which is one forty-millionth of the earth's circumference passing through its poles, and is equivalent to a length of 39.37 inches.

The unit of length in the metric system is the *meter;* the unit of capacity is the *liter*; the unit of weight is the *gram.* A meter is one ten-millionth of the distance from the equator to the pole; this is equivalent to 39.37 inches. The liter is the capacity of a cube having an edge one tenth of a meter in length. The gram is the weight of a cube of distilled water having an edge one one-hundredth of a meter in length.

The use of the metric system for linear, surface, and volume measures would greatly facilitate the solution of problems in which lengths, surface, and volume are involved. The reason for this is that ten of one denomination makes one of the next higher denomination. In this respect the metric system is similar to dollars and cents. Thus, in the metric system if it is desired to add a number of distances, the process would be the same as adding a number of dollars and cents, which is simpler than adding feet, yards, rods, and miles. The same is true of surface and volume measures.

The fractional parts of the standard units in the metric system are expressed by the use of Latin prefixes and the multiples of the standard units by Greek prefixes. The Latin prefixes are: *milli-* which means .001; *centi-* which means .01; and *deci-* which

means .1. The Greek prefixes are: *deca-* which means 10; *hecto-* which means 100; *kilo-* which means 1,000; and *myria-* which means 10,000. The prefixes mean the same whether annexed to meter, liter, or gram.

MEASURES OF LENGTH

The unit of measures of length is the meter. The following table is applicable to the measurement of lengths expressed in meters and a decimal of a meter:

10 millimeters (mm.)	=1 centimeter (cm.)	=	.01	meter
10 centimeters	=1 decimeter (dm.)	=	.1	meter
10 decimeters	=1 meter (m.)	=	1.	meter
10 meters	=1 decameter (Dm.)	=	10.	meters
10 decameters	=1 hectometer (Hm.)	=	100.	meters
10 hectometers	=1 kilometer (Km.)	=	1,000.	meters
10 kilometers	=1 myriameter (Mm.)	=	10,000.	meters

The following table shows the metric system applied to the present system of linear measure as expressed in inches, feet, yards, rods, and miles:

1 centimeter	= .3937 in.	1 in.	=2.54001 centimeters
1 decimeter	= 3.9371 in.	1 ft.	= .304801 meter
1 meter	=39.37 in.	1 yd.	= .914402 meter
1 decameter	= 1.98 rd.	1 rd.	=5.029 meters
1 hectometer	=19.88 rd.	1 mi.	=1.60935 kilometers
1 kilometer	= .62138 mi.		
1 myriameter	= 6.2138 mi.		

EXERCISE No. 269, APPLICATION OF THE TABLES

When it is desired to change the expression of measurement from one denomination of the metric system to another, move the decimal place to the right if the expression is to be changed from a higher to a lower denomination, and to the left if it is to be changed from a lower to a higher denomination. Thus, if it is desired to express 71.5 meters as decimeters, the expression would be 715 decimeters; if it is desired to change 941.25 centimeters to meters, the expression would be 9.4125 meters.

When it is desired to express a length given in inches, feet, yards, etc., in meters or a fraction of a meter, multiply each denomination by its equivalent and add, or change all the denominations to the lowest denomination or some one denomination and fraction and multiply by its equivalent. Thus, if it is desired to express the length 5 ft. and 3 in. by the metric system, change 5 ft. to 60 in., add the 3 in., and multiply 63 by 2.54001, the

equivalent expression of an inch as centimeters. The product will be the desired number of centimeters, decimeters, or meters depending upon the value of the product. $63 \times 2.54001 = 160.02063$ centimeters. This is equivalent to 16.002063 decimeters, or 1.6002063 meters.

When the measurement is expressed in meters or decimal fraction of a meter and it is desired to express this same measurement in inches, feet, etc., it is necessary to divide the metric measurement by its equivalent. Thus, if it is desired to change 160.02063 centimeters to an equivalent expression in feet and inches, divide by 2.54001, the equivalent in inches to ascertain the number of inches and then reduce these inches to feet, which is the reverse of the process explained in the preceding paragraph.

Measurements should always be expressed in the proper denominations. If the distance is great and miles, rods, yards are involved, the expression should be in the proper denomination and not in inches. If the length expressed is short and involves only inches and feet, it should be expressed in both denominations and not in inches. Since the metric system is a decimal system, the proper denomination is indicated by the decimal point, hence it is not necessary to refer to 16,171 meters as meters but as 1 myriameter, 6 kilometers, 1 hectometer, 7 decameters, and 1 meter. When expressing length by feet, inches, etc., it is necessary to designate each denomination, but when expressing measurement in the metric system, the position of the decimal point indicates all the denominations without expressing them.

The following problems provide written practice in (a) changing measurements expressed in inches, feet, yards, rods, and miles to equivalent lengths expressed by the metric system; and (b) changing measurements expressed by the metric system to equivalent lengths expressed in inches, feet, yards, rods, and miles.

1. The distance between two cities is 67.2138 kilometers. Write each digit in this number at the left of the proper metric denomination.

2. The distance between two cities is 87.7 miles. Express this in metric measurement.

3. A door is 6 ft. 10 in. high, and 2 ft. 11 in. wide. Express both these lengths in the metric system.

4. The top of a desk is 1.5 meters long and .88 meters wide. Express the dimensions in inches.

5. A certain city block is 16 rds. 4 yds. 3 ft. and 7 in. in length. Show this length in the proper metric denominations.

6. The home of A. H. Dorney is on a lot which fronts 31.7 meters on Locust Street. Express this in millimeters.

7. A room is 11 ft. $6\frac{3}{4}$ in. in width, and 14 ft. $7\frac{3}{8}$ in. in length. Express this width and length in the proper denominations of the metric system.

8. One side of a field measures 87 rds. 5 yds. 2 ft. 6 in. What is the length expressed in metric denominations?

9. The distance between New York City and Washington is 225.4 miles. Express this distance in the proper denominations of the metric system.

MEASURES OF AREA

The unit of square measure for small surfaces is the square meter. The standard unit for measuring land is the are. In measures of area, one hundred units of any denomination are required to make one of the next higher. The following table shows the method of expressing square measure by the metric system:

100 sq. millimeters	= 1 sq. centimeter (sq.cm.)	=	.0001	sq. meter	
100 sq. centimeters	= 1 sq. decimeter (sq. dm.)	=	.01	sq. meter	
100 sq. decimeters	= 1 sq. meter (sq. m.)	=	1.	sq. meter	= 1 centare
100 sq. meters	= 1 sq. decameter (sq.Dm.)	=	100.	sq. meters	= 1 are
100 sq. decameters	= 1 sq. hectometer (sq.Hm.)	=	10,000.	sq. meters	= 1 hectare
100 sq. hectometers	= 1 sq. kilometer (sq. Km.)	=	1,000,000.	sq. meters	

The following table shows the metric surface measure equivalents to square inches, square feet, square yards, etc.:

1 sq. cm.	= .155 sq. in.	1 sq. in.	= 6.452 sq. cm.
1 sq. dm.	= .1076 sq. ft.	1 sq. ft.	= .0929 sq. m.
1 sq. m.	= 1.196 sq. yd.	1 sq. yd.	= .8361 sq. m.
1 are	= 3.954 sq. rd.	1 sq. rd.	= 25.293 sq. m.
1 hectare	= 2.471 acres	1 acre	= 40.47 ares
1 sq. Km.	= .3861 sq. mi.	1 sq. mi.	= 259. hectares

The method of changing the denominations of surface measure in the metric system is the same as in changing the denominations in the linear measure. The method of changing surface measure expressed in square inches, square feet, etc., to the equivalent metric denomination is the same as in the linear measure. Thus, to change the metric denominations, the decimal point is moved either to the left or to the right and the result multiplied by the U. S. equivalent. To change the U. S. units to the metric system each denomination is multiplied by its metric equivalent and the products added, or all the denominations are changed to one denomination and this result multiplied by its metric equivalent.

CUBIC MEASURE

The practical unit of measures of volume is the cubic meter. In measuring wood the cubic meter is called a stere. In measures of volume, one thousand units of any denomination are required to make one of the next higher. The table is as follows:

1,000 cu. millimeters (cu. mm.)	=1	cu. centimeter (cu. cm.)	= .000001	cu. meter
1,000 cu. centimeters	=1	cu. decimeter (cu. dm.)	= .001	cu. meter
1,000 cu. decimeters	=1	cu. meter (cu. m.)	=1.	cu. meter

The following table shows the metric equivalent to cu. in., cu. ft., and cu. yd.:

1 cu. cm.	= .061 cu. in.	1 cu. in.	=16.387 cu. cm.
1 cu. dm.	= .0353 cu. ft.	1 cu. ft.	=28.317 cu. dm.
1 cu. m.	=1.308 cu. yds.	1 cu. yd.	= .7645 cu. m.
1 stere	= .2759 cord	1 cord	= 3.674 steres

The method of changing the denominations of cubic measure in the metric system is the same as in changing the denominations in the linear measure. The method of changing cubic measure expressed in cubic inches, etc., to equivalent metric denominations is the same as in linear measure.

MEASURES OF CAPACITY

The unit of capacity for both liquid and dry measures is the liter, which as previously explained is a cube the side of which is one decimeter. The tables are as follows:

Liquid

10 milliliters (ml.)	=1 centiliter	=	.01	liter
10 centiliters (cl.)	=1 deciliter	=	.1	liter
10 deciliters (dl.)	=1 liter	=	1.	liter
10 liters (l.)	=1 decaliter	=	10.	liters
10 decaliters (Dl.)	=1 hectoliter	=	100.	liters
10 hectoliters (Hl.)	=1 kiloliter	=	1,000.	liters

NOTE: A fluid ounce is equal to $\frac{1}{16}$ of a pint, or $\frac{1}{4}$ of a gill.

Dry

10 milliliters (ml.)	=1 centiliter	=	.01	liter
10 centiliters (cl.)	=1 deciliter	=	.1	liter
10 deciliters (dl.)	=1 liter	=	1.	liter
10 liters (l.)	=1 decaliter	=	10.	liters
10 decaliters (Dl.)	=1 hectoliter	=	100.	liters
10 hectoliters (Hl.)	=1 kiloliter	=	1,000.	liters

The following tables show the metric equivalents to pints, quarts, gallons, etc.:

Liquid

1 cl. = .338 fluid ounces		1 fluid ounce = .02957 liter	
1 dl. = .845 gills		1 gill = .118295 liter	
1 l. = 1.0567 quarts		1 pint = .47318 liter	
1 Dl. = 2.6418 gallons		1 quart = .94636 liter	
1 Hl. = 26.418 gallons		1 gallon = 3.78543 liters	
1 Kl. = 264.18 gallons			

Dry

1 cl. = .000908 qts.		1 pint = .5506 liter	
1 dl. = .00908 qts.		1 quart = 1.1012 liters	
1 l. = .0908 qts.		1 peck = 8.80982 liters	
1 Dl. = .908 qts.		1 bushel = .35239 hectoliter	
1 Hl. = 2.8378 bu.			
1 Kl. = 28.378 bu.			

EXERCISE No. 270, MEASURES OF CAPACITY

The following problems provide written practice in applying the information given in the above tables. Show all of your calculations on tablet paper.

1. Express the contents of a bottle of cream which contains one half of a pint as centiliters.

2. Express the capacity of a bucket which contains 10 quarts as decaliters.

3. Express 30 bushels 3 pecks 7 quarts in deciliters.

4. A bin used for storing grain contains 568 bushels. What is its contents expressed in decaliters?

5. An automobile tank contains 20 gallons of gasoline. What is its contents expressed in liters?

6. A bottle contains three fourths of a pint. What is its contents expressed in milliliters?

7. What is the value of 871 decaliters of wheat at $1.20 per bushel?

8. What is the value of a tank of gasoline containing 4,581 gallons at 46c per liter?

9. Express the value of 6 liters of oats as a decimal of a bushel.

10. What is the cost price of 21 gallons of maple syrup at 28c per decaliter?

MEASURES OF WEIGHT

The unit of weight is the gram. The table is as follows:

10 milligrams (mg.)	= 1 centigram (cg.)	=	.01 gram
10 centigrams	= 1 decigram (dg.)	=	.1 gram
10 decigrams	= 1 gram (g.)	=	1. gram
10 grams	= 1 decagram (Dg.)	=	10. grams
10 decagrams	= 1 hectogram (Hg.)	=	100. grams
10 hectograms	= 1 kilogram (Kg.)	=	1,000. grams
10 kilograms	= 1 myriagram (Mg.)	=	10,000. grams
10 myriagrams	= 1 quintal (Q.)	=	100,000. grams
10 quintals	= 1 tonneau (T.)	=	1,000,000. grams

The following table shows the metric system of weights applied to the present system of weights as expressed in grains, ounces, pounds, etc.

1 centigram	= .1543 grains			
1 decigram	= 1.5432 grains	1 grain	= .0648	grams
1 gram	= 15.4324 grains			
1 decagram	= .3527 ounces			
1 hectogram	= 3.5274 ounces	1 ounce (a.)	= 28.3495	grams
1 kilogram	= 2.2046 pounds			
1 myriagram	= 22.0462 pounds	1 pound (a.)	= .45359	Kg.
1 quintal	= 220.4621 pounds			
1 tonneau	= 2,204.6212 pounds	1 ton	= 907.2	Kg.

EXERCISE No. 271, MEASURES OF WEIGHT

The following problems provide written practice in applying the information given in the above tables. Show all of your calculations on tablet paper.

1. Express 9 pounds 6 ounces in decigrams.

2. What is the value of 7 decagrams 5 grams of meat at 14c per pound?

3. Express 6 pounds 7 ounces in decigrams.

4. Express 8 quintals 7 myriagrams 4 kilograms in ounces.

5. How many grains are there in $6\frac{1}{2}$ hectograms?

6. Express 4 pounds 5 ounces in milligrams.

7. Express 5.25 decigrams 8.75 centigrams in grains.

8. Express 6 pounds 5 ounces in centigrams.

9. How many grains are there in 3.5 grams?

10. Express 6 centigrams 5.25 milligrams in grains.

CHAPTER XXXV

REVIEW PROBLEMS

You are to show on tablet paper all of the calculations necessary to arrive at the desired facts in each problem.

1. A train leaves New York at 4:05 p. m. and arrives in Cincinnati at 9:10 the next morning. Show by compound subtraction the time required for the train to make the trip; taking into consideration the change of one hour in Columbus, due to the change from Eastern to Central time.

2. What is the cost of twelve pieces of lumber each fourteen inches long, five inches thick, and nine inches wide at $31.75 per thousand?

3. Robert Anderson contracted with the Johnson Construction Company to construct a home on a basis of cost plus 10%. This means that the Johnson Construction Company is to receive 10% of the cost as its profit for building and supervising the building. The bill presented by the Johnson Construction Company was $12,786.55. (a) What was the cost to the Johnson Construction Company, and (b) what was their commission for constructing the house?

4. The Men's Furnishing Company purchased one hundred men's straw hats, and marked them to sell at the beginning of the season for $5. 65 were sold at this price, and then they were marked down to $3. 22 were sold at this price. The remaining hats were sold at $1. (a) What was the cost of the hats if the company's net profit on the sale of them was $22\frac{1}{2}\%$? (b) How much would the profit have been, had they sold 72 hats at $5, 12 at $3 and the remainder at $1?

5. Robert Moore received $1.25 per hour for his services with time and one half for overtime, on a basis of eight hours per day. During the month of June his wages were $312.50. How much overtime did he work, provided he put in full time each of the twenty-six workdays?

6. The Acme Manufacturing Company produced 225,516 units of a certain product. The cost of material used in the manufacture of these units was $17,641.85. The labor cost was $22,481.60, and the manufacturing expense and operating cost was $8,227.48. What was (a) the material cost per unit; (b) the labor cost per unit; (c) the manufacturing expense and operating cost per unit; and (d) the total cost per unit? Prove your results.

7. The Dow Construction Company purchased land for a subdivision. This land was located on two improved roads which crossed at right angles. The frontage on one road was 2,550 feet and on the other road, 1,050 feet. They divided this into nine city blocks, each block 800 by 300 feet, with a 50 foot street on each side. Each city block was subdivided into 32 lots 50 by 150 feet, each lot fronting 50 feet on a street with the corner lots fronting 150 feet on the cross streets. The cost of the land was $27,500, and the cost of laying off the streets and lots, $12,450. You are to ascertain, (a) the cost price per acre based on the purchase price and cost of improvements; and (b) the cost price of each lot based on the purchase price and cost of improvements.

8. The following statement regarding the affairs of the Street Railway Company in a certain city was published in one of the daily newspapers:

Operating Revenue		$597,860.02
Operating Expenses		415,287.78
Net Operating Revenue		182,572.24
Taxes		56,333.18
Operating Income		126,239.06
Nonoperating Income		1,134.71
Gross Income		127,373.77
Rentals, Interest, Sinking Funds, etc.		121,698.69
Surplus		5,675.08
Revenue passengers	7,030,298	
Transfer passengers	2,379,558	
Free passengers	102,113	
Total passengers carried	9,511,969	

You are to ascertain (a) the per cent of operating expense based on operating revenue, (b) the per cent of net operating

revenue paid as taxes, (c) the per cent of transfer passengers based on the total number of passengers carried, (d) the per cent of free passengers based on the total number of passengers carried, and (e) the average fare received from the total number of passengers carried based on the operating revenue.

9. The Thayer Mercantile Company allows its customers a discount of 1% for cash in ten days. During one year the total sales were $86,521.40, and the total discount deducted by customers for prompt payment was $648.60. What was the per cent of discount based on the sales?

10. C. H. Andrews has a $10,000 20-payment life insurance policy taken out at the age of 28 which has been in effect ten years. During the tenth year, that is before the eleventh payment had been made, he wishes to borrow the full loanable value given in the table on page 411. How much cash will he receive on a six months loan, if the interest rate is $5\frac{1}{2}$%, and the interest is collected in advance on the maximum amount of the loan?

11. Mr. Maddox wishes to pay the balance due on the account below, December 31. He is to pay interest on past due bills from date of maturity to date of settlement, and to receive interest on payments from the date they were made up to and including date of settlement. Through error he was not allowed discount on payment of April 9, which should be adjusted. Omit the two bills which were paid within the terms.

ROBERT MADDOX

April 1, 2/10, n/30	$507.22	April 9	$300.00
May 5, 60 days	321.55	May 1	100.00
June 27, 2/15, n/30	409.16	July 7	409.16
July 18, 30 days	198 27	July 1	300.00
Aug. 17, 60 days	427.55	Aug. 17	198.27
Sept. 15, net	306.40	Oct. 1	200.00
Oct. 1, 30 days	609.37	Nov. 1	500.00

You are to ascertain the amount of the check received from Mr. Maddox on the date of settlement, interest at 6%.

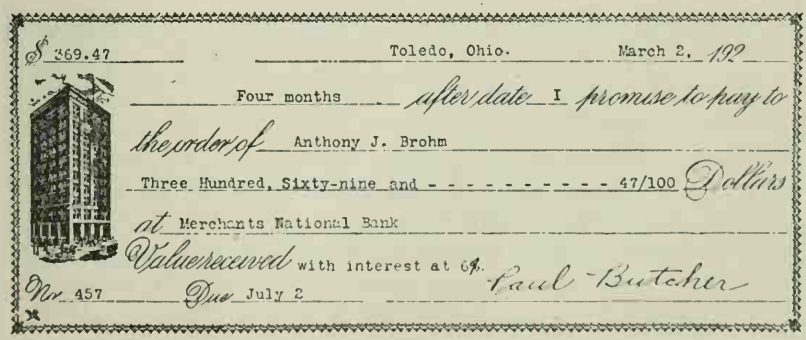
12. A book contains 320 pages. It was printed on sheets of paper 24 by 36 inches, 16 pages on each side. The publishers, Brown Brothers, wish to have another edition of 25,000 copies

printed, and asked for a quotation from the printers on the required quantity, printed on paper 24 by 36 inches, each ream of 500 sheets weighing 50 pounds. The contract was awarded to the Krehbiel Printing Company for $12,568.75. Later it developed that paper of the size desired was not available and could not be obtained from the mill, but paper in sheets 25 by 38 inches, 60 pounds to the ream was available. It was decided to use this larger size sheet and allow the printers to add the difference in cost to their bill for making the 25,000 books. You are to ascertain, (a) the increase in cost, the price of either paper being $7.85 per hundred pounds, due to the change; (b) the price per book, if the paper specified in the contract could have been obtained; and (c) the price per book using the larger paper.

13. How many cubic feet of coal are there in a car containing 67,581 pounds. A bushel of coal weighs 80 pounds and contains 2,747.71 cubic inches.

14. A paper mill makes paper 144 inches wide and operates at the rate of 650 lineal feet per minute. (a) How many reams of paper 24 by 36 inches will this machine manufacture in 24 hours continuous running? (b) How many pounds, if the paper weighed 45 pounds to the ream?

15. May 16, the Wayland Grocery Company discounted the note illustrated below at the First National Bank, rate of discount being 7%. (a) How much credit did the bank allow them for the proceeds of the note?


$369.47 Toledo, Ohio. March 2, 19?

Four months after date I promise to pay to

the order of Anthony J. Brohm

Three Hundred, Sixty-nine and - - - - - - - - - - 47/100 Dollars

at Merchants National Bank

Value received with interest at 6%. Paul Butcher

No. 457 Due July 2

16. How much will it cost to dig a ditch 28 inches wide, 38 inches deep, and 92 rods long at 85c per cubic yard.

17. A printing press prints 1,750 impressions per hour and prints a sheet which contains 64 pages on each side. At $3.25 per hour, what will it cost to print 22,000 catalogs each containing 320 pages, printed in three colors, each color requiring a separate impression?

18. An aeroplane ascends to a height of 16,482 feet. Express this: (a) in miles and decimal of a mile; (b) in the proper denominations of the metric system.

19. June 27, the A. C. Gray Grocery Company purchased 25 crates of blackberries at $3.45 per crate of 36 quarts. They sold 288 quarts at 15c, 396 quarts at two for 25c, 2 crates at 11c per quart, and the remainder at 10c per quart. (a) What was the company's profit, and (b) the per cent of profit based on the selling price?

20. The manager of the Arnold Drug Company, wholesale druggists, wishes to budget the various operating expenses for the coming year. He desires the selling expenses to be the same rate per cent as for the past year, but to be based on an increase of 20% in sales. The sales for the past year were $186,524.78, and the selling expenses were $16,942.50. What will be the appropriation for selling expenses during the coming year?

21. The Mayo Manufacturing Company paid $17,500 for a machine used in one of its departments. It was decided to depreciate this machine at 15% of cost each year. At the end of the fifth year, the machine was exchanged for another machine at a trade-in value of $1,500. (a) What was the book value of the machine at the time it was traded in? (b) At what rate per cent each year should the machine have been depreciated to make the book value the same as the trade-in value?

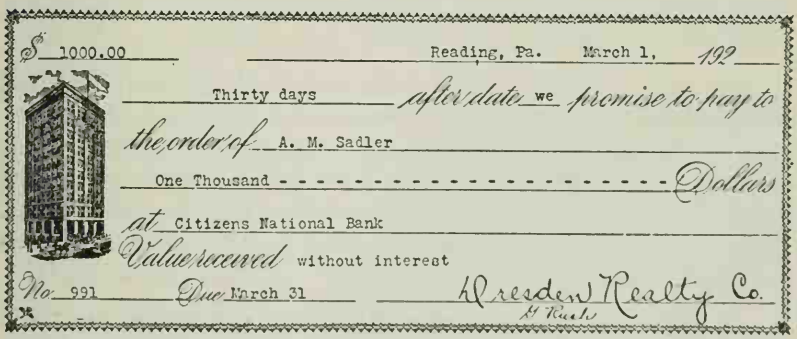
22. J. T. Jenkins and C. J. Mann formed a partnership for operating a cash and carry grocery business. Jenkins invested $6,000 and Mann invested $5,000 at the beginning of the business, May 1. It was agreed that each was to share in the profits or losses in proportion to their investment. At the end of the first year, the assets of the business were $16,471.80 and the liabilities, $3,107.64. What was the net proprietorship of each partner in the net assets?

23. The net earnings of a Street Railway Company during a certain year were \$3,962,700. During this year, tickets were sold at 6 for 51c. It is now proposed to operate on a basis of 6 tickets for 45c. (a) What will be the income for the next year assuming that all income is the result of selling tickets, and (b) what will be the estimated income for the second year, assuming that the number of passengers carried will increase 5% because of the reduced fare?

24. Canned corn is packed in cans $2\frac{7}{8}$ inches in diameter by $4\frac{5}{8}$ inches in height, outside dimensions. What will be the inside measurements of a packing case that will contain four dozen of these cans placed in two tiers of two dozen each, four cans wide and six cans long.

25. Davis Brothers, retail merchants, carried insurance on their stock as follows: Company A, \$5,000; Company B, \$6,000; Company C, \$3,000; Company D, \$4,000; Company E, \$4,000; Company F, \$5,000. Each policy had a 90% coinsurance clause. Damage to the stock due to a fire was \$926. The merchandise on hand at the time of the fire was worth \$35,550. What amount of the damage was each company required to pay?

26. What is the amount due December 10, the date of settlement, on the note illustrated below with the following credits on the back: April 10, \$150; May 15, \$200; August 12, \$300; October 1, \$250.



Use the Merchants' Rule, interest 6% after maturity.

27. The Fair Store Company reduced the price of a bedroom suite 25%. If this reduction amounted to $87.50, (a) what was the price before the reduction? (b) If the per cent of the gross profit before the reduction was 32.5, what was the per cent of profit after the reduction?

28. What will be the value of a note dated May 1, for $500 due in ninety days with interest at 6% (a) on May 27; (b) on June 16; or (c) on July 1?

29. F. C. Marsh, a merchandise broker, received from the Campbell Manufacturing Company a check for $387.65 as a commission for the sale of their products during a certain month. If the commission was $2\frac{1}{2}\%$, what was the amount of his sales?

30. Add the following columns and show proof of the first three by the elimination of 9's, and show proof of the two at the right by the elimination of 11's.

a	*b*	*c*	*d*	*e*
48,577	$47,367	58,473	$376.34	48,576
74,836	48,376	68,574	384.56	68,574
85,746	38,475	39,287	394.65	48,379
92,837	29,387	57,664	685.67	95,847
57,483	93,846	93,847	485.94	57,463
93,847	85,742	48,376	738.68	68,574
57,468	49,587	57,463	523.33	58,473
57,468	67,564	29,487	847.57	94,837
94,899	57,463	94,857	493.67	84,738
38,276	39,487	94,837	574.98	38,472
58,699	49,392	94,857	384.84	57,664
68,572	48,579	57,463	983.27	96,889

31. John Douglas owns forty-seven of the five hundred shares of capital stock issued by the Atlas Manufacturing Company. At the end of the business year, the net assets of this corporation were $62,971.46. (a) What is the book value of each share of stock which Mr. Douglas owns? (b) If the price of this stock on the stock exchange is $118\frac{7}{8}$, what is the difference between the book value and the market value of his forty-seven shares?

32. The McAlpin Department Store has five departments in addition to the office. It is desired to charge each department and the office with its proportional part of the rent when paid

each month. The annual rent is $9,000. The space occupied by each department is as follows: Department A, 1,850 square feet; Department, B, 1,600 square feet; Department C, 3,250 square feet; Department D, 750 square feet; Department E, 3,580 square feet; the office, 1,220 square feet. You are to ascertain the desired distribution of rent.

33. The inventory of the Moore Grocery Company at the beginning of the year was $13,007.66, and at the end of the year, $14,045.75. The purchases during the year were $90,722.64, and the sales, $112,475.80. You are to ascertain: (a) the turnover; (b) cost of goods sold; (c) gross profit on sales; and (d) the per cent of gross profit based on sales.

34. W. H. Maynard had an account of $267.50 for merchandise sold D. C. Daly. This account was referred to an attorney for collection on a 15% commission basis. Before the collection was made, Mr. Daly became insolvent, and a final adjustment of his affairs resulted in a settlement of 60c on the dollar. How much did Mr. Maynard receive from the attorney in settlement of his claim?

35. During a period of five consecutive years, the Kees Brothers Grocery Company made sales as follows: first year, $8,467.50; second year, $19,721.50; third year, $22,417.25; fourth year, $16,217.40; fifth year, $21,675.42. Prepare a bar graph showing these sales in $100 units.

36. Beginning January 1, G. F. Strong deposits $25 of his salary in a savings bank on the first of each month. If the interest rate is 4%, and it is compounded semi-annually on January 1 and July 1 of each year, how much will he have on deposit at the end of the third year?

37. A. L. Moffet had his home and furnishings insured with three companies as follows: Company A, building, $2,000 and furnishings $1,000; Company B, building, $2,500 and furnishings, $1,000; Company C, building, $2,500, furnishings, $500. An adjusted fire loss showed damage to the building of $850, and to furnishings, $525. Ascertain the amount of this loss which each company was required to pay.

38. A college has an endowment fund of $50,000 which it is required to keep invested at $5\frac{1}{2}\%$. At what price must it buy 4% bonds in order to realize $5\frac{1}{2}\%$ on the investment?

39. A. R. Jansen wishes to purchase a draft on the Bank of England for 250 pounds. How much will this cost him in dollars and cents, brokerage $\frac{1}{8}\%$?

40. What is the difference in per cent between trade discounts of 15%, 10%, 10%, and 5%, and discounts of 25% and 15%?

41. The Globe Clothing Company purchased clothing on May 10, with a dating of October 1, 2/10, 1/30, n/60; the amount of the purchase being $7,251.65. They have an agreement to the effect that any payments made before October 1 are to be subject to discount, and draw interest at 6% from the date of payment up to and including October 1. The purchase was settled as follows: June 15, $1,000; September 1, $500; October 1, $1,500; October 9, $2,000; November 1, $1,500; December 1, balance. You are to ascertain, (a) the amount of credit for each payment in accordance with the agreement; and (b) the amount required to pay the balance of the invoice on December 1.

42. A manufacturer of bath tubs allows trade discounts of 5%, 15%, and 20% one year, and 10%, 15%, and 5% the next year. You are to ascertain, (a) the net price of a bath tub listed at $160 with the trade discounts allowed the first year; (b) the net price with the discounts allowed the second year; (c) what is the difference between the two net costs?

43. L. J. Culver purchased a Victrola from the Willis Music Company for $225. He paid $50 cash and contracted to pay the balance in installments of $25, payable on the first of each month, with interest at 6% beginning with the second payment. He paid the interest on the balance at the time each payment was made. What was the amount of each monthly payment?

44. July 1, C. J. Cartby purchased a home for $9,500. He paid $2,500 cash, and contracted to pay the balance in monthly installments of $200 with interest at 6%. At the time each monthly installment was paid, he paid the interest on the balance. At the end of two years, he had accumulated sufficient funds to pay the balance. You are to ascertain, (a) the amount required to pay the indebtedness at that time; and (b) the cost of the home including principal and interest.

45. May 1, D. L. Deabert purchased one \$1,000 5% bond of the Eastman Manufacturing Company at 98. On the same day he purchased ten shares of 8% preferred stock at $116\frac{5}{8}$. At the end of the year he sold the bond at $97\frac{5}{8}$ and the stock at $113\frac{3}{8}$. During the year, he collected the interest on the bond and received a dividend of 8% on the stock. You are to ascertain, (a) the profit made on the bond; (b) the profit made on the stock; and (c) show the per cent of income from each investment.

46. Frank Finn collected \$42.65 interest on a loan for 87 days at 7%. What was the amount of the loan?

47. How much will it cost to lay a hardwood floor on a room 22 feet 6 inches by 17 feet 4 inches at 35c per square foot?

48. What is the value of 9 tons 781 pounds of Pocahontas coal at \$9.25 per ton?

49. Automobile manufacturers were required to pay a Federal tax of 5% on the net factory cost of each automobile. A new law reduced this tax to 3%. The manufacturer of a certain automobile advertised a reduction of \$19.68, because of this 2% reduction of the tax. (a) You are required to ascertain the manufacturer's cost of this automobile; (b) if the automobile referred to is advertised to sell for \$1,320 at the factory, and if the dealers are allowed 20% of the advertised selling price as a commission for selling, what profit does the manufacturer make on each automobile sold; (c) what is the manufacturer's per cent of profit based on the sales?

50. J. F. Sherwood is advised that the lot on which his home is located is taxed at \$12,000 per acre and the building at \$18,500. How much will be the tax assessed against Mr. Sherwood if his lot is 150 feet wide and 300 feet deep, and the tax rate is 22.37 mills?

51. It is desired to oil the street on which Mr. Sherwood's lot is located. Each property owner is to pay his proportional part of the cost of oiling. An oil company contracts to oil the street which is 785 yards long and 60 feet wide for \$825.50. What part of the contract price will Mr. Sherwood be required to pay?

52. The number of cash fares collected by the street railway system in a certain city on the first day of May was as follows: first hour (beginning at seven o'clock in the morning), 37,500;

second hour, 22,200; third hour, 21,150; fourth hour, 18,400; fifth hour, 11,800; sixth hour, 12,500; seventh hour, 14,500; eighth hour, 15,900; ninth hour, 20,400 tenth hour, 23,600; eleventh hour, 36,400; and twelfth hour, 33,500. During the month a reduction in fares was decided upon. On the first day of June the following cash fares were collected during the day beginning at the same hour; first hour, 38,400; second hour, 23,400; third hour, 22,500; fourth hour, 19,700; fifth hour, 12,600; sixth hour, 13,500; seventh hour, 15,800; eighth hour, 16,400; ninth hour, 21,500; tenth hour, 24,300; eleventh hour, 37,500; and twelfth hour, 34,200. Prepare a curved graph showing a comparison of the cash fares collected during each of these two months.

53. The Goldey Clothing Company uses the word "impersonal" for marking the cost price of merchandise offered for sale. Show the correct marking on the following articles using x as a repeater.

a. Shoes which cost $3.85
b. Ties which cost 37c each
c. Ties which cost 88c each
d. Shirts which cost $1.35 each
e. Suits which cost $17.85 each
f. Suits which cost $22.50 each
g. Coats which cost $7.95 each
h. Caps which cost 33c each
i. Socks which cost 29c per pair
j. Socks which cost 88c per pair

54. A hardware merchant bought axes at $15.00 per dozen less 20% and 10%. At what price must he sell each ax to make $33\frac{1}{3}\%$ profit?

55. The express rate on merchandise between two cities is $1.75 per hundred pounds. The freight rate on the same classification of merchandise is 62c per hundred pounds. The Express Company calls for and delivers merchandise. The drayage on freight to the depot is 25c per hundred pounds. What will it cost to ship 1,163 lbs. (a) by express; (b) by freight; (c) what per cent is saved by shipping the merchandise by freight?

56. May 16, the Jacobs Mercantile Company sold Robert Mayfield merchandise worth $421.75, terms, net, thirty days. June 16, they accepted from Mr. Mayfield a check for one half of the bill, and a 6% interest-bearing note due in ninety days for the balance. July 2, this note was discounted at the bank for 7%. What were the net proceeds?

57. August 12, the Estate Stove Company sold the Middleton Brothers Company eighteen No. 7 stoves at $16.50 each, less discounts of 15% and 5%. The terms of sale were 1% for a sixty-day trade acceptance in ten days. August 15, the First National Bank presented a trade acceptance to the Middleton Brothers Company for acceptance. They proposed to pay the trade acceptance less 5% interest to maturity instead of accepting it, and the bank accepted their proposition. August 17, the Estate Stove Company received a remittance from the First National Bank for the amount collected from Middleton Brothers less one eighth of 1% collection charges. What was the amount of this remittance?

58. The Day Construction Company received a bid from the Green Hills Lumber Company for the following desired quantities of lumber: 27 pieces, 2″ x 4″ x 12′, $41.50 per M; 82 pieces, 3″ x 4″ x 14′, $44 per M; 62 pieces, 2″ x 6″ x 16′, $45 per M; 37 pieces, 4″ x 4″ x 10′, $39.50 per M; 62 pieces, 1″ x 10″ x 14′, $42.50 per M. They also received a bid from the Shoe Lumber Company on the same quantities of lumber at the following prices which are given in the same order as the descriptions above: $42, $43.75, $44.80, $40, $42. You are to ascertain: (a) the value of the lumber in accordance with each bid; (b) the saving if purchased from the lowest bidder; and (c) the per cent of saving.

59. What price must be asked for 900 pounds of coffee, costing 24c per pound, in order that the seller may deduct 10% from the asking price, allow $16\frac{2}{3}$% for loss in roasting, and still gain 20% on the cost?

60. W. F. Murray was offered $1.45 per bushel for his wheat, but he decided to have it ground and sell the flour. It cost $2\frac{1}{4}$c per bushel to take it to the mill. The miller took a toll of $\frac{1}{8}$ for grinding. It took $4\frac{2}{3}$ bushels to make a barrel of flour. He paid 50c a piece for barrels, and 25c per barrel commission to sell it. He sold 75 barrels for $450 and 25 barrels for $165. If the bran and refuse were sold for $100, (a) did he gain or lose on the 100 barrels, and (b) how much?

61. The amount of a certain principal at a certain rate for 3 years is $302.50, and the same principal at the same rate for 5 years would amount to $337.50. (a) Find the principal, and (b) the rate of interest.

62. I invested all my money in a 5% bond at 60, and my income was \$450. How much must I borrow to invest in a 6% bond at 84 to have the same income?

63. A man owns $\frac{4}{5}$ of a steamboat and insures 80% of $\frac{3}{4}$ of his interest at $1\frac{1}{4}$%, paying \$112.50 premium. (a) What was the value of his interest in the boat? If, before the policy expires, the boat should be damaged by fire to the extent of \$5,000, (b) what sum will he receive from the insurance company?

64. On a mortgage for \$5,200, dated June 16, 1924, the following payments were made: August 12, 1924, \$300; June 15, 1925, \$125; August 19, 1926, \$1,200; May 4, 1927, \$50; December 24, 1928, \$2,000. What was the balance due February 12, 1929, at 6%? (Solve by U. S. rule.)

65. The assessed value of the real estate in a town is \$1,197,500, and the personal property, \$432,500. A poll tax of \$1.50 per head is assessed on 2,150 persons. The town votes to raise \$8,000 for schools, \$1,500 for highways, \$1,500 for salaries, \$1,250 for the support of the poor, and \$347.50 for expenses. (a) What is the rate per cent of taxes, and (b) how much tax will a manufacturing company have to pay on a plant valued at \$46,500 and stock at \$19,750?

66. What will be the cost at 24c per square yard for plastering the ceiling and walls of a room 50 feet long, 40 feet wide, and 18 feet high, allowance being made for four doors, 4 feet 6 inches wide by 10 feet 6 inches high, and twelve windows each 3 feet 6 inches wide by 7 feet high?

67. An agent sold a house at 2% commission. He invested the net proceeds of the sale in city lots, after deducting his commission of 3% for buying them, and found that his commissions amounted to \$700. For how much was the house sold?

68. A cistern which holds 560 gallons is empty. It has a supply pipe which fills it in 20 hours, and a discharge pipe which will empty it in 14 hours. If the supply pipe has been running into the cistern for 4 hours and then both pipes are opened, in what time will it be empty?

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Find int $P \times P \times T = I$.

$P \times R \times T = I$

~~$P \times T = P$~~

Int Fac $= M.V.$

$MV \times R \times T =$ Discount

$MV - D = PV$

$B - P \div R$

$P - R \times B$

$R - P \div B$

Date due - in mo

Time for int - exact days

~~$B - P \div R$~~

~~$P - R \times B$~~

~~$R - P \div B$~~